# I/P, E/P & P/I Transducers

- Type 1000
- Type 1000EX
- Type 1000HR
- Type 1000 Hazardous Use
- Type 1001
- Type 1001 Nema 3R
- Type 1001 Nema 4X
- Type 1500
- Type 1500 Zero Based
- Type 2000
- Type 2000 Hazardous Use
- Type 5000

# Type 1000

## I/P & E/P Transducers

### Description

The Type 1000 Transducer is an electro-pneumatic device that reduces a supply pressure to a regulated output pressure directly proportional to an electrical input signal. The Type 1000 accepts a wide range of supply pressures, ranging from a minimum of 3 psig (0.2 BAR) above the maximum output up to 100 PSIG (6.9 BAR). An integral pneumatic volume booster is included in the design to provide high flow capacity (up to 12 SCFM/339 SLPM). Model selections include general purpose, NEMA 4X Type, extended range, high relief, intrinsically safe, and explosion proof.

### Applications

The Type 1000 Transducer converts an electrical signal to a pneumatic output which can be used to operate the following:

- Valve actuators
- Damper and louver actuators
- Valve positioners
- Controllers
- Relays
- Air cylinders
- Clutches and brakes

**Used in:**

- Liquid, gas and slurry processing instrumentation
- HVAC systems
- Paper handling controls
- Textile processing systems
- Energy management systems
- Petrochemical processing systems

### Standard Features

- Low Cost
- Built-in Volume Booster
- Small Size
- Field Reversible
- Low Air Consumption
- Mounts at Any Angle
- Convenient External Span & Zero Adjusts (Except for Explosion Proof Models)
- Light Weight
- Wide Supply Pressure Range
- Low Supply Pressure Sensitivity

### Principle of Operation

The Type 1000 Transducer is a force balance device in which a coil is suspended in the field of a magnet by a flexure. Current flowing through the coil generates axial movement of the coil and flexure. The flexure moves against the end of a nozzle, and creates a back pressure in the nozzle by restricting air flow through it. This back pressure acts as a pilot pressure to an integral booster relay. Consequently, as the input signal increases (or decreases, for reverse acting), output pressure increases proportionally. Zero and span are calibrated by turning easily accessible adjusting screws on the front face of the unit. The zero adjusting screw causes the nozzle to move relative to the flexure. The span adjusting screw is a potentiometer that limits the current through the coil. A thermistor circuit in series with the coil provides temperature compensation.

### Split Ranging

The 4-20 mA input, 3-15 PSIG output model can be recalibrated to provide 3-9 PSIG or 9-15 PSIG output, for split ranging applications.

### Mounting

The Type 1000 transducers can be pipe, panel, or bracket mounted in any position. Positions other than vertical will require recalibration of the zero adjustment. For maximum output pressure stability, the Type 1000 should be mounted in a vibration-free location or such that vibration is isolated to the X and Z axis shown on the dimensional drawings.

### Field Reversible

All Type 1000 transducers are calibrated at the factory for direct acting operation but may be used in the reverse acting mode by reversing the polarity of the signal leads and recalibrating. When calibrated for reverse acting applications, the Type 1000 transducers provide a minimum of their full rated output pressure (i.e., 15, 27, or 30 PSIG) upon input signal failure.

### Type 1000 for Extended Range

#### Description

The Bellofram Extended Range I/P and E/P Transducers are based on Bellofram's proven Type 1000 transducer line - the best selling transducers in the business.

The large span adjustment range of this line allows recalibration to fit applications with output ranges from approximately 3-35 PSIG (0.2-2.4 BAR) to 3-145 PSIG (0.2-10 BAR).

The units accept supply pressures up to 150 PSIG (10.5 BAR) and provide flow capacity to 24 SCFM (677 SLPM).

The Type 1000 I/P and E/P Transducers are more cost effective and more accurate than typical high output systems using transducers coupled to boosting or multiplying relays.

### Type 1000 with High Relief

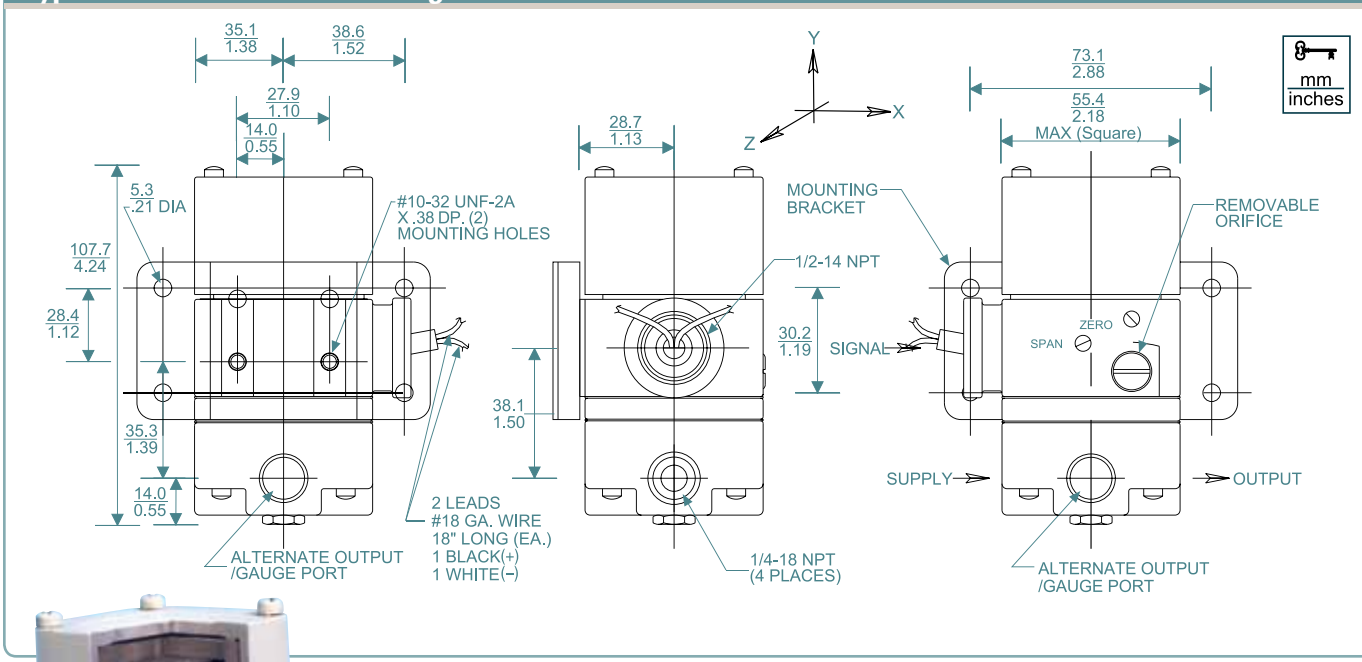
#### Description

Expanding upon the proven accuracy, reliability, and rugged construction of the Type 1000 General Purpose, these transducers provide extra fast "blowdown" for a very rapid release of downstream pressure. The extra relief feature makes these units suitable for cylinder return stroke actuation, air hoists, and similar applications requiring fast exhaust. These units accept supply pressures to 100 PSIG (6.9 BAR), with output ranges from 1-17 PSIG (0.07-1.2 BAR) to 6-30 PSIG (0.4-2.1 BAR), and provide exhaust capacities of 7 SCFM (336 SLPM).

## Type 1000 Transducers

| | | Type 1000 General Purpose | Type 1000 High Relief | Type 1000 Extended Range | Type 1000 Explosion Proof |
|---|---|---|---|---|---|
| Supply Pressure Range | | 3 PSIG (0.2 BAR) above max. output to 100 psig (7 BAR) | 3 PSIG (0.2 BAR) above max. output to 100 PSIG (7 BAR) | 5 PSIG (0.4 BAR) above max. output to 150 PSIG (10.4 BAR) (100 PSIG / 7 BAR for 2-60 PSIG / 0.1-4.1 BAR models) | 3 PSIG (0.2 BAR) above max. output to 100 PSIG (7 BAR) |
| Supply Pressure Sensitivity | | ±0.15% of span per 1.5 PSIG (0.1 BAR) | ±0.15% of span per 1.5 PSIG (6.1 BAR) | ±0.004% of span per 1.0 PSIG (0.07 BAR) | ±0.15% of span per 1.5 PSIG (0.1 BAR) |
| Linearity (terminal based) | | <1.0% of span | <1.0% of span | <2.0% of span | <1.0% of span |
| Repeatability | | <0.5% of span | <0.5% of span | <0.5% of span | <0.5% of span |
| Hysteresis | | <1.0% of span | <1.0% of span | <1.0% of span | <1.0% of span |
| Minimum Flow Rate at Midrange 100 PSIG / 7 BAR | | 12 SCFM (339 SLPM) | 12 SCFM (339 SLPM) | 24 SCFM (677 SLPM) 150 PSIG (10.4 BAR) Supply | 12 SCFM (339 SLPM) |
| Exhaust Capacity @ 5 psig (0.4 BAR) above setpoint | | 2 SCFM (56.5 SLPM) | 7 SCFM (336 SLPM) | 2 SCFM (56.5 SLPM) | 2 SCFM (56.5 SLPM) |
| Air Consumption (max) at Midrange | | 0.1 SCFM (2.8 SLPM) | 0.1 SCFM (2.8 SLPM) | 0.07 SCFM (2.0 SLPM) | 0.1 SCFM (2.8 SLPM) |
| Port Size (pneumatic / electric) | | 1/4 NPT and 1/2 NPT | 1/4 NPT and 1/2 NPT | 1/4 NPT and 1/2 NPT | 1/4 NPT and 1/2 NPT |
| Size | inches | 2-1/8 X 2-1/8 X 4 | 2-1/8 X 2-1/8 X 4 | 2-1/8 X 2-1/8 X 4 | 6-13/32 X 5-15/16 X 7-9/16 |
| | mm | 54 X 54 X 101 | 54 X 54 X 101 | 54 X 54 X 101 | 163 X 151 X 192 |
| Weight | | 2.1 lb. / 0.95 Kg | 2.1 lb. / 0.95 kg | 2.1 lb. / 0.95 kg | 5.2 lb. / 2.4 kg |

## Type 1000 Dimensional Drawing

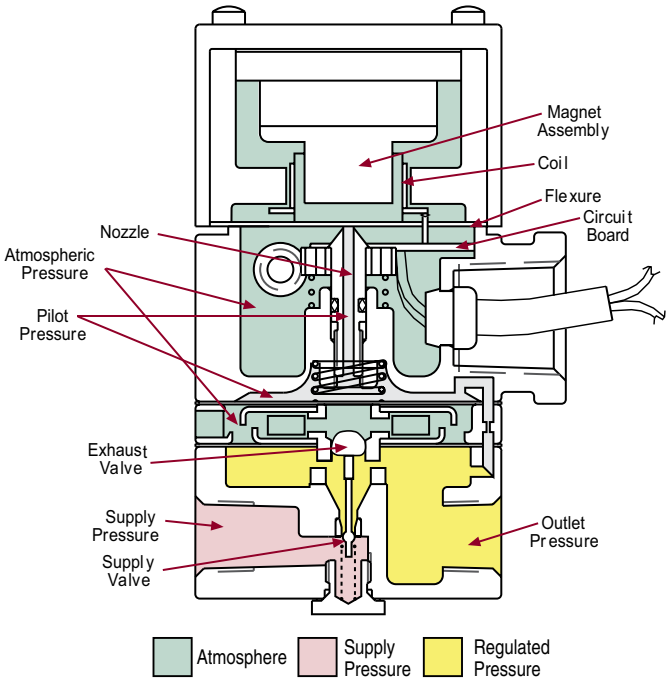


**The Type 1000 has long been a standard in the I/P & E/P industry. With a built-in booster, the T-1000 provides a flow capacity up to 12 SCFM, making it a versatile transducer for many applications.**

## Type 1000 General Purpose Ordering Information

| Input | Output* | | Part Number | Impedance (Nominal) |
|---|---|---|---|---|
| | BAR | PSIG | | |
| 4-20mA | 0.2-0.6 | 3-9 | 961-072-000 | 90 Ω |
| | 0.6-1.0 | 9-15 | 961-073-000 | 90 Ω |
| | 0.2-1.0 | 3-15 | 961-070-000 | 180 Ω |
| | 0.2-1.9 | 3-27 | 961-074-000 | 220 Ω |
| | 0.4-2.1 | 6-30 | 961-075-000 | 220 Ω |
| | 0.07-1.2 | 1-17 | 961-116-000 | 250 Ω |
| | 0.2-1.0 | 3-15 | 961-089-000 | 180 Ω |
| 10-50mA | 0.2-1.0 | 3-15 | 961-076-000 | 70 Ω |
| | 0.2-1.9 | 3-27 | 961-077-000 | 85 Ω |
| | 0.4-2.1 | 6-30 | 961-078-000 | 85 Ω |
| 0-5V | 0.2-1.0 | 3-15 | 961-079-000 | 615 Ω |
| | 0.2-1.9 | 3-27 | 961-080-000 | 530 Ω |
| | 0.4-2.1 | 6-30 | 961-081-000 | 530 Ω |
| 1-9V | 0.2-1.0 | 3-15 | 961-085-000 | 985 Ω |
| | 0.2-1.9 | 3-27 | 961-086-000 | 840 Ω |
| | 0.4-2.1 | 6-30 | 961-087-000 | 840 Ω |

NOTE: For NEMA4X, add 004 suffix.




## Type 1000 Extended Range Ordering Information

| Input | Output* | | Part Number | Impedance (Nominal) |
|---|---|---|---|---|
| | BAR | PSIG | | |
| 0-60mA | 0.1-8.3 | 2-120 | 961-107-000 | 220 Ω |
| 4-20mA | 0.2-8.3 | 3-120 | 961-111-000 | 260 Ω |
| | 0.1-4.1 | 2-60 | 961-117-000 | 225 Ω |
| 0-10V | 0.2-8.3 | 3-120 | 961-112-000 | 805 Ω |
| 0-5V | 0.1-4.1 | 2-60 | 961-118-000 | 500 Ω |

## Type 1000 High Relief Ordering Information

| Input | Output* | | Part Number | Impedance (Nominal) |
|---|---|---|---|---|
| | BAR | PSIG | | |
| 4-20mA | 0.2-0.6 | 3-9 | 961-130-000 | 90 Ω |
| | 0.6-1.0 | 9-15 | 961-131-000 | 90 Ω |
| | 0.2-1.0 | 3-15 | 961-132-000 | 180 Ω |
| | 0.2-1.9 | 3-27 | 961-133-000 | 220 Ω |
| | 0.4-2.1 | 6-30 | 961-134-000 | 220 Ω |
| | 0.2-1.0 | 3-15 | 961-135-000 | 180 Ω |
| | 0.07-1.2 | 1-17 | 961-136-000 | 250 Ω |
| 10-50mA | 0.2-1.0 | 3-15 | 961-137-000 | 70 Ω |
| | 0.2-1.9 | 3-27 | 961-138-000 | 85 Ω |
| | 0.4-2.1 | 6-30 | 961-139-000 | 85 Ω |

## Agency Approval Notes

**Factory Mutual**
**T-1000 I/P Transducers**
**Intrinsically Safe:** Class I, Division 1, Groups A, B, C, & D, T6
**Non-Incendive:** Class I, Division 2 , Groups A, B, C, & D, T6.
**T-1000 I/P / E/P Transducer**
**Explosion Proof:** Class I, Division 1, Group D, T6
**Dust-Ignition Proof:** Classes II & III, Division 1, Groups E, F, & G, T6
Type 4 **NEMA 4**

**Canadian Standards Association**
**T-1000 I/P Transducers**
**Hazardous Locations:** Class I, Group D; Class II, Groups E, F, & G; Class III; CSA Enc. 4 **NEMA 4**:
I/P transducer, supply pressure 100 psig max, input 4-20mA, output 3-15 psig.
**Intrinsically Safe and Non-Incendive Systems - For Hazardous Locations:** Class I, Groups A, B, C, & D; Class II, Groups E, F, & G; Class III:
I/P transducer rated input 4-20mA, intrinsically safe when connected through CSA Certified diode safety barriers in accordance with Bellofram Installation Instruction.

Explosion proof, intrinsically safe, and non-incendive ratings are not affected by recalibrating for split range or reverse acting applications.

The Bellofram T-1000 Transducers were tested and found to comply with Electromagnetic Compatibility Directive effective January 1, 1996. The relevant EMC specifications tested were the following: EN 50081-1 (1992) and EN 50082-1 (1992). A Technical Construction File, Serial #107 was written and Certificate of Conformity issued by a Competent Body.

## Type 1000 Options and Accessories

| | Part Number |
|---|---|
| Explosion Proof Mounting Kit | 971-079-000 |
| Explosion Proof Panel Mounting Kit | 971-078-000 |
| DIN Rail Kit | 010-115-000 |
| Hirschman Connector Kit (3-prong) | 971-126-000 |
| Filter Kit, 60 micron | 010-139-000 |
| Output Gauges | Option "8" ie: last 3 digits become - 008 |
| Dielectric Strength Testing | Option "12" ie: last 3 digits become - 012 |
| NEMA 4X Type Enclosure Option | Option "4" ie: last 3 digits become - 004 |

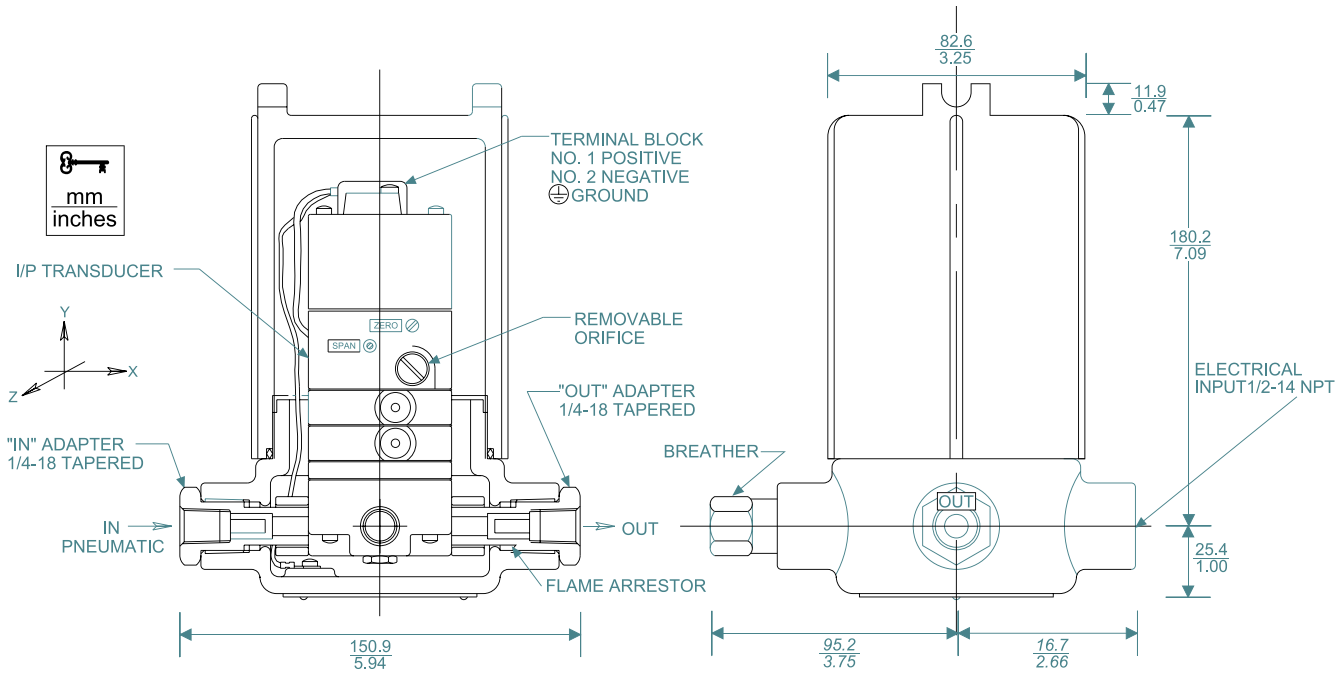
## Filter Note

Bellofram specifies the use of instrument quality air (clean, dry, oil-free) for all transducers. The use of filters in the supply air system is highly recommended. Contact us for information on our filters and filter regulators.

* For output pressures less than 3 PSI (0.2 BAR) or greater than 30 PSI (21 BAR), the Type 1000 transducer can be coupled to Bellofram Type 75 pneumatic relay. Consult Applications Engineers for further information.

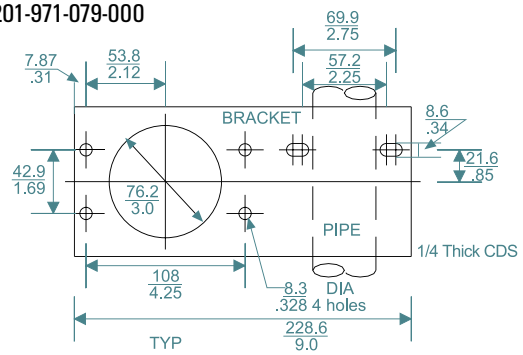
** NEMA 4 type enclosure option available on all input/output ranges. This option is separate from explosion proof, NEMA 4 units.

## Type 1000 Explosion Proof Dimensional Drawing;



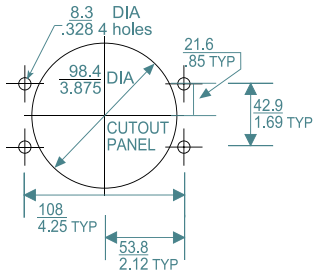

### Optional Mounting Bracket & Hardware

Order kit #201-971-079-000




### Optional Mounting Hardware

Order Kit #201-971-078-000




Drawings and dimensions are for reference only.

## Type 1000 Hazardous Location Use Ordering Information

| Input | Output* BAR | Output* PSIG | Part Number | Impedance (Nominal) | Agency Approvals (See notes) |
|---|---|---|---|---|---|
| **Type 1000 Explosion Proof** | | | | | |
| 4-20mA | 0.2-1.0 | 3-15 | 961-098-000 | 180 Ω | Explosion-Proof, Factory Mutual[1] |
| | 0.2-1.0 | 3-15 | 961-098-100 | 180 Ω | CSA Explosion Proof |
| 1-9v | 20-100 | 3-15 | 961-142-000 | 985 Ω | Explosion Proof Factory Mutual[1] |
| **Type 1000 Intrinsically Safe** | | | | | |
| 4-20mA | 0.2-1.0 | 3-15 | 961-099-000 | 180 Ω | Intrinsically Safe, Factory Mutual [3,4] |
| | 0.2-1.9 | 3-27 | 961-100-000 | 220 Ω | Intrinsically Safe, Factory Mutual [3,4] |
| | 0.2-1.0 | 3-15 | 961-105-000 | 180 Ω | Intrinsically Safe, CSA[5] |
| | 0.2-1.9 | 3-27 | 961-106-000 | 220 Ω | Intrinsically Safe, CSA[5] |
| | 0.4-2.1 | 6-30 | 961-101-000 | 220 Ω | Intrinsically Safe, Factory Mutual [3,4] |
| | 1.0-0.2 | 15-3 | 961-175-000 | 180 Ω | Intrinsically Safe, Factory Mutual [3,4] |
| | 1.9-0.2 | 27-3 | 961-176-000 | 220 Ω | Intrinsically Safe, Factory Mutual [3,4] |
| | 2.1-0.4 | 30-6 | 961-177-000 | 220 Ω | Intrinsically Safe, Factory Mutual [3,4] |

*For output pressures less than 3 psi or greater than 30 psi the Type 1000 transducer can be coupled to Bellofram Type 75 pneumatic relay. Consult application engineers for further information.

# Type 1001

## I/P & E/P Transducers

### Description

The Type 1001 is a patented family of electro-pneumatic instruments that is used to reduce a supply pressure to a regulated output pressure which is directly proportional to a two-wire current or three-wire voltage input. This design incorporates closed loop sensing of the output pressure to achieve excellent accuracy and vibration stability. It also features a unique damping circuit which can be adjusted to prevent over-shoot and actuator "hunting." Model selection includes General Purpose (NEMA 1), Rainproof (NEMA 3R), and Watertight/Corrosion Resistant (NEMA 4X). NEMA 4X models are also explosion-proof, and all models are intrinsically safe.

### Features

- 0.1% accuracy typical
- Closed loop pressure feedback control minimizes effects of vibration, temperature, supply pressure and mounting angle
- Built-in volume booster provides flows up to 12 SCFM
- Easy access zero and span adjustment
- Damping pot prevents over shoot and "hunting"
- Low air consumption
- Mounts at any angle (NEMA 3R limited)
- Compact and lightweight
- Virtually no sensitivity to supply pressure changes
- Removable orifice (screw) for easy maintenance

### Applications

The Type 1001's precisely regulated pneumatic output can be used to operate:

- Valve actuators
- Louver and damper actuators
- Valve positioners
- Relays
- Clutches and brakes
- Controllers
- Air cylinders

### Industry Applications Include:

- Liquid and Gas Processing
- Pulp and Paper
- Petrochemical Processing
- HVAC Systems
- Textile Productions
- Energy Management
- Environmental Control
- Medical Equipment

### Calibration Adjustments

The Type 1001 contains multi-turn Zero and Span adjustment potentiometers which are accessible on NEMA 1 models by sliding the cover window open to its first detent position. Pots are clearly distinguished by legend on the cover. On NEMA 3R and 4X models, the cover should be removed to reach the pots (marked Z for zero and S for span).

Adjust the pots clockwise to increase Zero and Span as required to optimize factory set output with appropriate input signal and supply pressure applied.

### Damping Adjustment

To eliminate undesirable system oscillation, the Type 1001 features a unique damping adjustment. The output response is optimized to varying downstream volumes by adjusting the feedback time constant of the coil drive amplifier. This is accomplished on NEMA 1 models by sliding the cover window open to its second detent position to expose the single-turn Damping Potentiometer (remove the cover on NEMA 3R and 4X models). To optimize response, turn the pot fully counterclockwise until system oscillation is just eliminated. System oscillation may be observed by monitoring output pressure or by observing the behavior of directly actuated system components in response to a changing input.

### Mounting

The Type 1001 transducers are designed to be position insensitive. They can be panel, valve, or pipe mounted at any angle (see NEMA 3R limitation) without a need for in place recalibration. Panel mounting can be either direct or with the bracket furnished with each unit. Mounting holes are located on the bottom and side to provide maximum mounting flexibility. Users may order the optional DIN Rail Adapter or a bracket suitable for either valve or 2" pipe mounting. Special pipe clamps may be ordered as a separate kit.

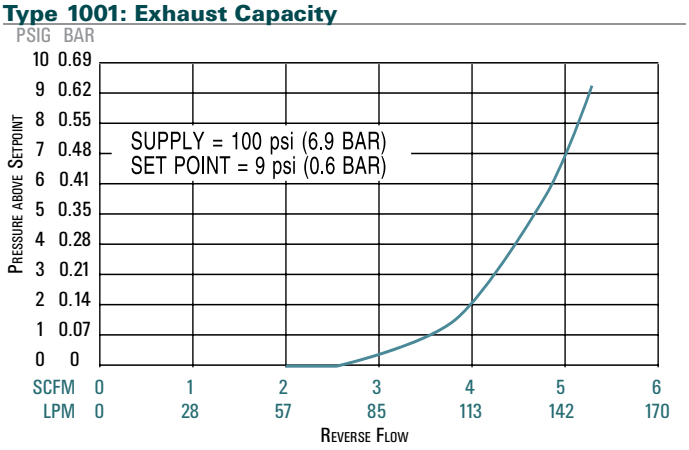
### Agency Approval Notes

**Factory Mutual**
**T-1001 I/P and E/P Transducers**
**Intrinsically Safe:**
Class I, Division 1, Groups A, B, C, & D, T6 Ta = 40°C
**Non-Incendive:** Class I, Division 2, Groups A, B, C, & D, T6
Entity Parameters: $V_{Max}$ = 28 V, $I_{Max}$ = 150 mA, $C_i$ = 0.22 µF, $L_i$ = 0.
T-1001 I/P and E/P Transducers Explosion Proof: Class I, Division 1, Groups B, C, & D, T6
**Dust-Ignition Proof:** Classes II & III, Division 1, Groups E, F, & G, T6 Type 4X **NEMA 4X**

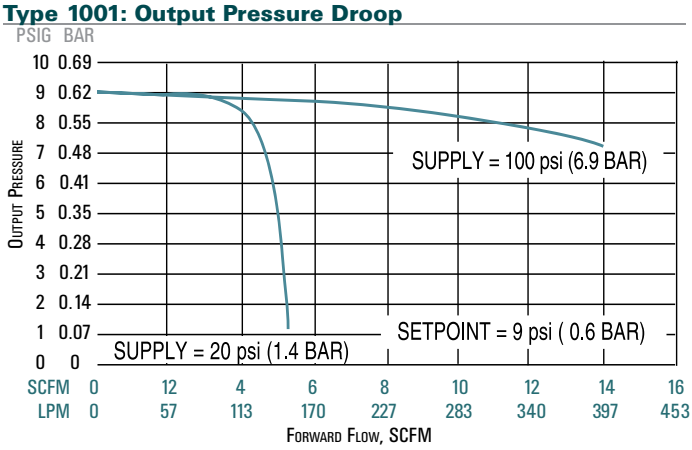
**Canadian Standards Association**
**T-1001 and T-1001XP I/P and E/P Transducers**
**Hazardous Locations:** Class I, Groups B, C, & D; Class II, Group E, F, & G; Class III; Encl 4 **NEMA 4**:
I/P or E/P transducer, input 4-20,10-50mA dc, 0-5, 1-5, 1-9 & 1-10V dc; supply voltage 40V dc max; supply current 100mA max; maximum ambient temp 70˚C.
Output pressure ranges:
Standard: 3-9, 9-15, 3-15, 3-27, 6-30, 1-17 psig.
Extended: 0-15, 0-120 psig.
T-1001 I/P and E/P Transducers
**Hazardous Locations:**
Class I, Division 2, Groups A, B, C, & D:
I/P transducer, rated input 4-20mA or 10-50mA, 30V dc max.
E/P transducer, rated supply 24V dc, 10mA, rated 0-5, 1-5,1-9 & 1-10V dc. IN COMPLIANCE WITH STD C22.2 No 213.
**Intrinsically Safe and Non-Incendive Systems - Hazardous Locations:**
Class I, Groups A, B, C, & D:
I/P transducer, rated input 4-20mA or 10-50mA, 30V dc max; intrinsically safe when connected through CSA Certified zener barrier devices or converters as per Bellofram Installation Instruction.
E/P transducer, rated supply 24V dc, 10mA; rated input 0-5, 1-5, 1-9 & 1-10V dc; intrinsically safe when connected through CSA Certified zener barrier devices as per Bellofram Installation Instructions.

The Bellofram T-1001 Transducers were tested and found to comply with Electromagnetic Compatibility Directive effective January 1, 1996. The relevant EMC specifications tested were the following: EN 50081-1 (1992) and EN 50082-1 (1992). A Technical Construction File, Serial # 107 was written and Certificate of Conformity issued by a Competent Body.

## Type 1001: Exhaust Capacity




## Type 1001: Output Pressure Droop




## Type 1001 Specifications

| | |
|---|---|
| Accuracy (per ISA 51.1) | ± 0.10% of output span, typical<br>± 0.25% of output span, maximum (Guaranteed) |
| Hysteresis | 0.01% of output span, typical<br>0.10% of output span, maximum |
| Dead Band | No effect |
| Repeatability | 0.01% of output span, typical<br>0.10% of output span, maximum |
| Ambient Temperature Effect | ± 0.004% of nominal span per °F, typical<br>±0.022% of nominal span per °F, maximum |
| Span | ±0.013% of calibrated span per °F, typical<br>±0.022% of calibrated span per °F, maximum |
| Temperature Effect | 0.02%/°F, zero and span effects combined |
| Operating Temperature Range<br>Buna-N elastomers<br>Viton elastomers | <br>-20°F to 160°F (-29 to 71°C)<br>0°F to 160°F (-18 to 71°C) |
| Storage Temperature Range<br>Buna-N elastomers<br>Viton elastomers | <br>-40°F to 200°F (-40 to 93°C)<br>-15°F to 200°F (-26 to 93°C) |
| Vibration Effect | Less than 0.5% of span per 1G,<br>5-2000 Hz, 3G maximum, 3 axes |
| Mounting Position Effect | Not measurable |
| Loop Load, I/P Transducer | Less than 10 VDC drop at 20 mA<br>Less than 12 VDC drop at 50 mA |
| Supply Voltage, E/P Transducer<br>Intrinsically Safe/Nonincendive<br>General Purpose | <br>9 VDC to 28 VDC, less than 20 mA<br>9 VDC to 40 VDC, less than 20 mA |
| Supply Voltage Effect | No effect |
| Signal Impedance, E/P Transducer | 6000 Ohm minimum |
| RFI/EMI Effect (NEMA 4X) | Less than 0.25% of span change in output<br>10V/meter, 20-1000 MHz.<br>(Reference SAMA PML 33.1-1978, 2-abc) |
| Supply Pressure Sensitivity | No effect |
| Air Consumption: | 0.07 SCFM (2 LPM) maximum |
| Supply Pressure | 100 psig (6.9 BAR) maximum |
| Port Sizes | Pneumatic: 1/4 NPT<br>Electrical: 1/2 NPT |

* For models with zero output capability maximum supply pressure = 40 PSI (2.8 BAR) above maximum output, except for 0-100 PSI and 0-120 PSI models that have a maximum supply pressure of 130 PSI (9 BAR) & 140 psi (9.7 BAR) respectively.

Bellofram specifies the use of instrument quality air (clean, dry, oil free) for all transducers.
Transducers should be used within the following conditions:
Dew Point < 35°F (2°C) (indoor); Oil Content < 1PPM; Particles < 3µm.
The use of filters in the supply air system is highly recommended. Contact us for information on our filters and filter regulators.

## Type 1001 Accessories

| Kits | Part Number |
|---|---|
| Panel Mounting Kit | 010135-000 |
| Valve Mounting Kit*** | 010134-000 |
| 2" Pipe Mounting Kit<br>(Valve Mounting Kit is required) | 010143-000 |
| DIN Rail Adapter | 010115-000 |
| Cover for Locking Device Kit<br>(for NEMA 4X enclosure only) | 010136-000 |
| Type 1 Orifice with Buna-N O-rings* | 010137-000 |
| Type 1 Orifice with Viton O-rings* | 010137-002 |
| Type 2 Orifice with Buna-N O-rings** | 010137-001 |
| Type 2 Orifice with Viton O-rings** | 010137-003 |
| Filter Kit, 60 microns | 010139-000 |
| Hirschmann® Connector Kit<br>(Din 43 650-A)<br>(3 prong plug, O-ring sealed) | 010142-000 |
| Pressure Gauge Kit, 15 PSI | 010138-000 |
| Pressure Gauge Kit, 30 PSI | 010138-001 |
| Pressure Gauge Kit, 60 PSI | 010138-002 |
| Pressure Gauge Kit, 160 PSI | 010138-003 |

* Type 1 Kits to be used with Ø based output units and 1-17 PSIG unit.
** Type 2 Kits to be used with all other units.
*** Supplied standard with Nema 4X

## Type 1001 Specials Table

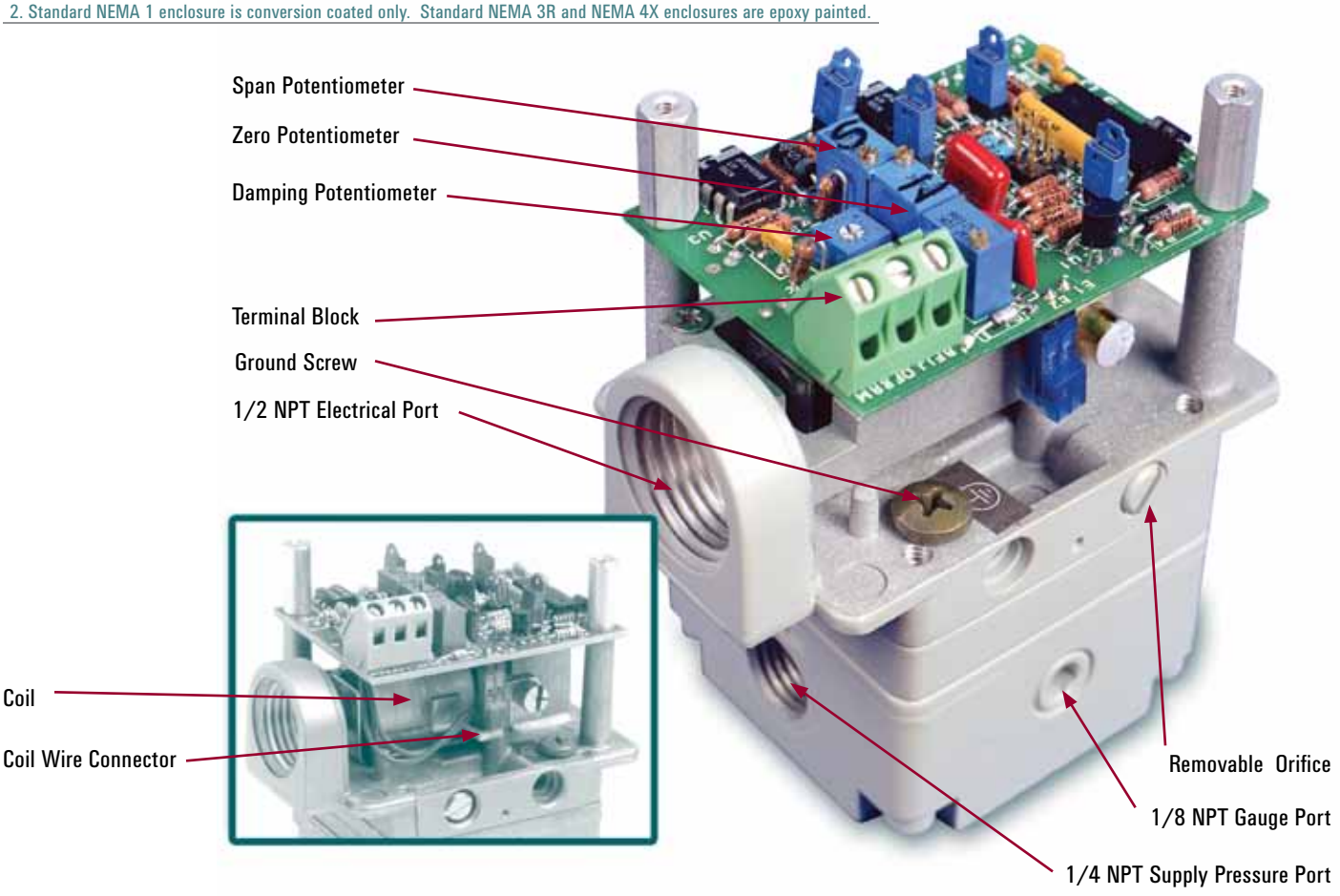
| Input | Output | Comments | Part Number |
|---|---|---|---|
| 4-20 mA | 20-100 kPa | NEMA 1 | 962-145-000 |
| 4-20 mA | 20-100 kPa | NEMA 3R | 962-146-000 |
| 4-20 mA | 0-200 kPa | NEMA 1 | 962-148-000 |

## Type 1001 Ordering Information

| 9 6 | | | | 0 | | |
|---|---|---|---|---|---|---|
| | ↑ | ↑ ↑ | ↑ | | ↑ ↑ | Enclosures |
| | 6 | | | | | NEMA 1, General Purpose[2] |
| | 7 | | | | | NEMA 3R, Rainproof[2] |
| | 8 | | | | | NEMA 4X, Water-tight, Dust-tight, Corrosion Resistant, and Explosion-Proof[2] |
| | | _ _ | | | | Calibration |
| | | | | | | See Input / Output matrix below[1] |
| | | | | | | Agency Approvals |
| | | | 0 | | | None |
| | | | 1 | | | Factory Mutual and CSA Explosion Proof |
| | | | | | | Options |
| | | | | | 00 | None |
| | | | | | 06 | Fluorocarbon Elastomeric Diaphragm |

Notes to Nomenclature:

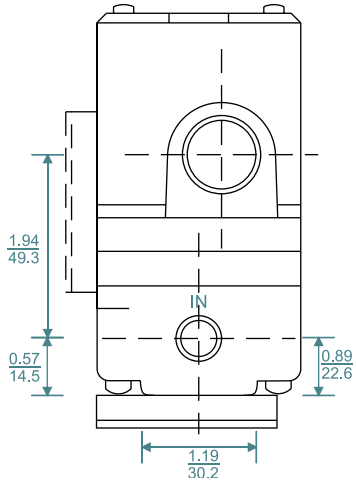
1. Transducer operating in the voltage mode (E/P), can be adjusted with the "span" potentiometer for any input between 0-10 VDC. The input range is limited to a minimum 4VDC difference between 100% and 0% Input voltage.
2. Standard NEMA 1 enclosure is conversion coated only. Standard NEMA 3R and NEMA 4X enclosures are epoxy painted.

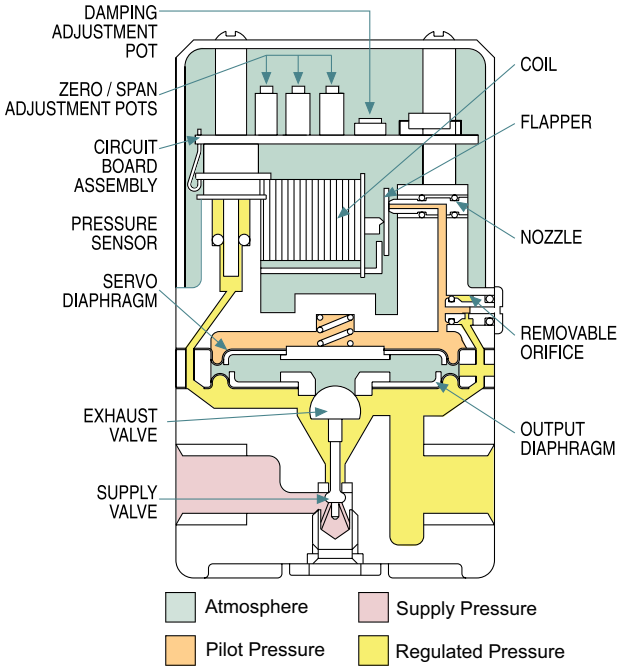



## Type 1001 Standard Input/Output Matrix

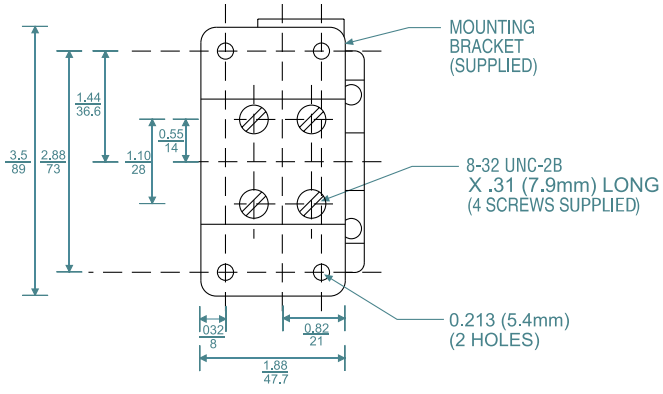
| PSIG | 0-5 | 0-15 | 0-30 | 0-60 | 0-100 | 1-17 | 3-15 | 3-27 | 6-30 | 3-9 | 9-15 | 0-2 | 0-120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-20 mA | 19 | 06 | 20 | 08 | 09 | 05 | 02 | 03 | 04 | 00 | 01 | 13 | 07 |
| 10-50 mA | 11 | 16 | A5 | 98 | 89 | 15 | 12 | 87 | 14 | 10 | 90 | B1 | 17 |
| 0-5 VDC | 21 | 26 | 18 | 28 | 29 | 25 | 22 | 35 | 24 | 30 | 31 | B2 | 27 |
| 1-5 VDC | A1 | 36 | A6 | 38 | 39 | 97 | 32 | 33 | 34 | 50 | 41 | B3 | 37 |
| 1-9 VDC | A2 | 46 | 40 | 48 | 49 | 45 | 42 | 43 | 44 | 60 | 51 | B4 | 47 |
| 1-10 VDC | A3 | 56 | B6 | 58 | 59 | 55 | 52 | 53 | 54 | 88 | 61 | B5 | 57 |
| 0-10 VDC | A4 | 66 | 70 | 68 | 69 | 65 | 62 | 63 | 64 | 80 | 99 | 23 | 67 |

## Front View



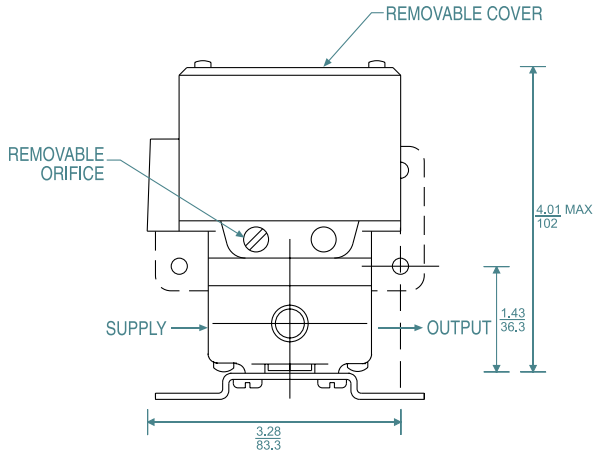




## Bottom View

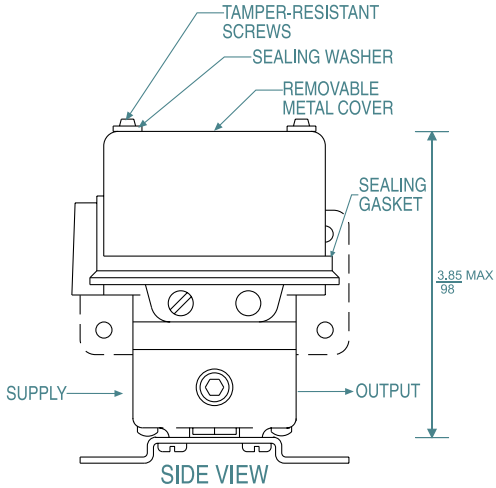



BOTTOM VIEW

## Side View

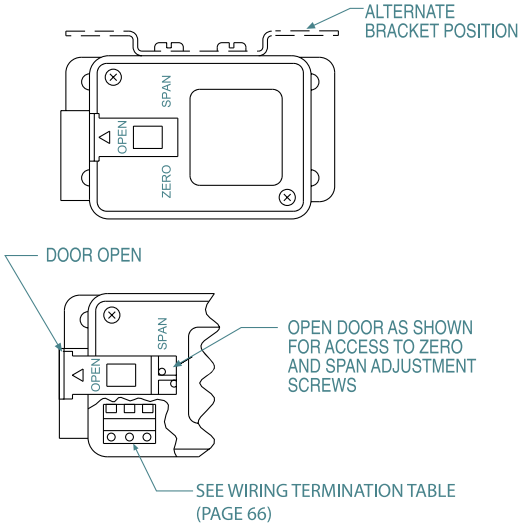



## Side View (Vertical Mount Only) NEMA 3R

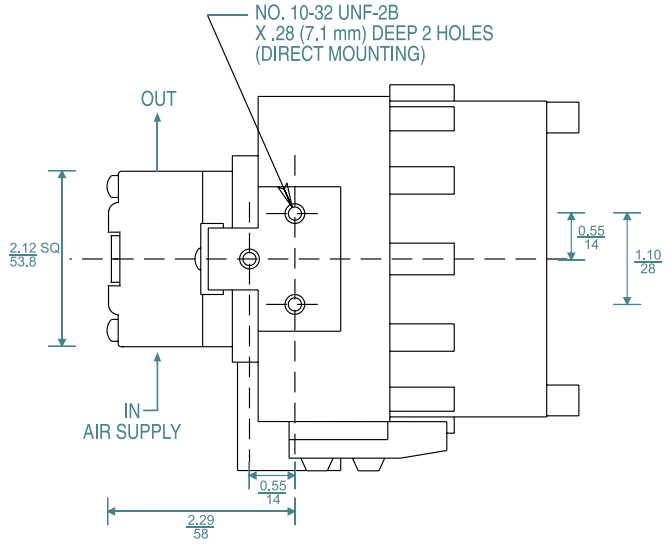


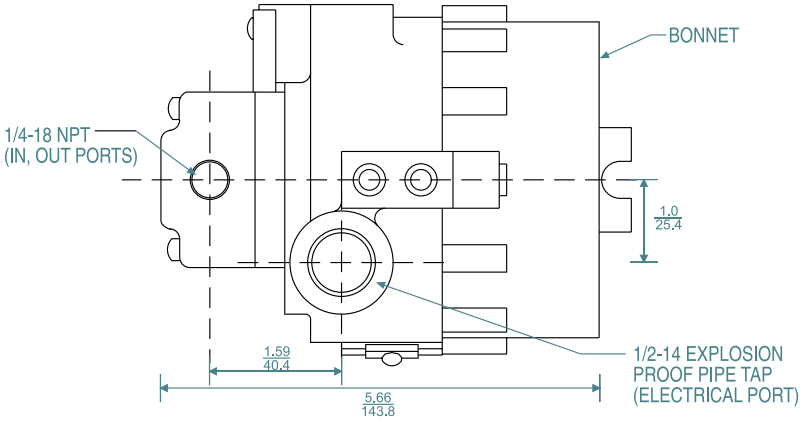

SIDE VIEW
(NEMA 3R-Vertical Mount Only)

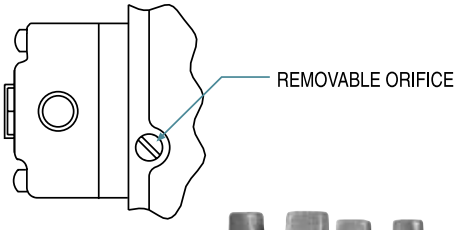
## Top View



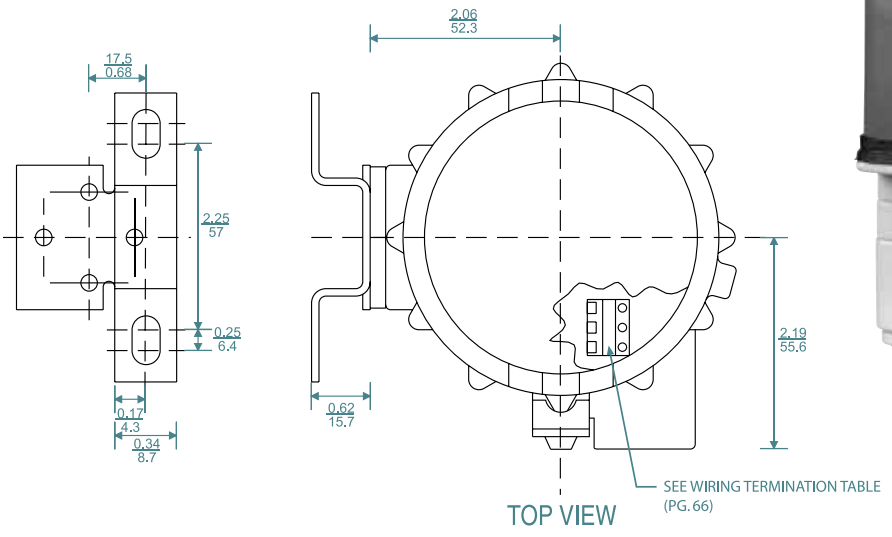
## Side Views




## Bottom View




## Type 1001 EX Wiring Termination

| PWB Terminal Block | I/P Transducer | E/P Transducer |
|---|---|---|
| Position 3 | Positive (+) | Supply (+) |
| Position 2 | No Connection | Common |
| Position 1 | Negative (-) | Signal (+) |

# Type 1500

## I/P & E/P Transducers

### Type 1500 Description

The T-1500 is a new series of electro-pneumatic transducers that convert an electrical signal to a proportional pressure output. It provides precision electro-pneumatic control to actuators, valves, positioners, final control elements and is ideally used for high-flow control devices. The Type 1500's compact size and accessibility to ports and adjustments allow the unit to be installed in space-constrained locations or in a manifold for multi-device control.

DIN rail and manifold assemblies are available in kits that provide three, five or ten mounting points.

An integral pneumatic volume booster is included in the Type 1500 design to provide high flow capacity. (See specifications for flow data.)

### Standard Features

- Small footprint, compact size
- Manifold mounting configurations
- Built-in volume booster
- Electrical Connections: Conduit 1/2 NPT or BSPT, Terminal Block, Hirschmann® Connectors (DIN 43 650-A)
- Supply and output ports on front and back of unit
- Low air consumption
- External zero and span adjustments
- Low cost
- Field accessible orifice
- Electrical conduit connection meets CE requirements

### Options Available

- Intrinsically Safe (FM, CSA, ATEX)
- NEMA 4X (FM, CSA) Excludes Terminal Block

### Applications

The T-1500 transducer can be used as an electro-pneumatic control device to operate:

- Valve actuators
- Valve positioners
- HVAC systems
- Material handling systems
- Paper handling controls
- Automation systems
- Liquid and gas processing systems

### Principle of Operation

(See Fig. 2 and 6) The T-1500 Transducer is a force balance device in which a coil is suspended in the field of a magnet by a flexure. Current flowing through the coil generates axial movement of the coil and flexure. The flexure moves against the end of a nozzle and creates a back pressure in the nozzle by restricting air flow. This back pressure acts as a pilot pressure to an integral booster relay. Consequently, as the input signal increases (or decreases for reverse acting), output pressure increases proportionally.

In the zero based T-1500, the output of the transducer section is routed to an integral negative bias booster relay. The bias relay allows the complete unit to regulate output pressure down to 0 psig/BAR. The bias relay also amplifies the output of the transducer which allows the zero based units to regulate higher output pressures than the standard T-1500.

Zero and Span are calibrated by turning easily accessible adjusting screws on the front face of the unit (see Figures 3, 4, 5, 7, 8 and 9). The zero adjustment causes the nozzle to move relative to the flexure. The span adjustment is a potentiometer that limits the flow of current through the coil. A thermistor circuit in series with the coil provides temperature compensation.

### Mounting

The T-1500 can be mounted at any angle but should be calibrated after mounting. For maximum output pressure stability, the T-1500 should be mounted vertically in a vibration free location or such that the vibration is isolated to the X and Z axis. The T-1500 can be in-line, panel, pipe, DIN rail or manifold mounted.

### Air Connections

1. Supply Air must be instrument quality air regulated between 5 PSI above maximum output pressure up to 120 PSIG / 8.3 BAR (See table: Supply Pressure Range).
2. Instrument-quality air consists of:
   a. A dew point less than 35 ˚F
   b. No particles larger than three microns
   c. Maximum oil content of 1 ppm
3. All unused ports must be plugged.

### Supply

Connect supply to either of two ports marked "IN" on the base of the transducer. Avoid getting pipe sealant inside the piping or transducer.

### Output

Connect output to either of two ports marked "OUT" on the base of the transducer. The second "OUT" port may be used for a pressure gauge.

## Type 1500 Transducers

| | Standard Range | Zero Based |
|---|---|---|
| Hysteresis | <0.75% of span | <1.0% of span |
| Repeatability | <0.5% of span | <0.5% of span |
| Linearity (Independent) | <0.75% of span<br><1.0% of span for fluorocarbon units | <1.0% of span |
| Flow @ Mid Range | 6.5 SCFM (Minimum) @ 15.0 PSIG / 1.0 BAR<br>output pressure, 120 PSIG / 8.3 BAR supply pressure | 9.0 SCFM (Minimum) @ 15.0 PSIG / 1.0 Bar<br>output pressure, 150 PSIG / 10.3 BAR supply pressure |
| Maximum Air Consumption | 3 SCFH @ 15 PSI / 1.0 BAR output pressure | 18 SCFH @ Maximum output pressure |
| Exhaust Capacity | >1.0 SCFM @ 5 PSI / 0.4 BAR above set point | >1.0 SCFM @ 5 PSI / 0.4 BAR above set point |
| Supply Pressure Range | 5 psi above maximum output up to 120 psig / 8.3 BAR maximum | 0-15 units: 25-150 PSIG / 1.7-10.3 BAR<br>0-30 units: 40-150 PSIG / 2.8-10.3 BAR<br>0-60 units: 70-150 PSIG / 4.8-10.3 BAR<br>0-120 units: 125-150 PSIG / 8.6-10.3 BAR |
| Weight | 1.3 lbs. | 1.63 lbs. |
| Port Size | 1/4 NPT, BSPT, BSPP | 1/4 NPT, BSPT, BSPP |
| Supply Pressure Sensitivity | <2.5% of span for a supply pressure change of 15 PSIG / 1.0 BAR | <1.7% of span change in output pressure over<br>full supply pressure range (0-120 units) |
| Temperature Range | -20°F to +150°F | -20°F to +150°F |
| Input Signal | 4-20 mA DC, 0-5 VDC, 1-5 VDC, 1-9 VDC, 0-10 VDC, 1-10 VDC | 4-20 mA DC, 0-5 VDC, 1-5 VDC, 1-9 VDC, 0-10 VDC, 1-10 VDC |
| Output Range | 3-15, 3-27, 6-30 PSIG<br>0.2-1.0, 0.2-1.9, 0.4-2.1 BAR | 0-15, 0-30, 0-60, 0-120 PSIG<br>0-1.0, 0-2.1, 0-4.1, 0-8.3 BAR |

Electrical Connections: Both the I/P & E/P versions are two-wire devices, plus a safety ground. The E/P requires a DC voltage input signal; example: 1 to 9 VDC.
The I/P models require an input current of 4 to 20 mA.

## Type 1500 Ordering Information

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **96** | | | | | | | | |
| | | | | | | | | Enclosure Rating |
| | **6** | | | | | | **0** | NEMA 4X (Includes Approvals) |
| | **9** | | | | | | | Indoor Use / General Purpose |
| | | | | | | | | "In and Out" Pneumatic Port Connections |
| | | **7** | | | | | | 1/4 NPT |
| | | **8** | | | | | | 1/4 BSPT |
| | | **9** | | | | | | 1/4 BSPP |
| | | | | | | | | Input (Signal) |
| | | | **1** | | | | | 4-20 mA DC |
| | | | **2** | | | | | 0-5 VDC |
| | | | **3** | | | | | 1-9 VDC |
| | | | **4** | | | | | 1-10 VDC |
| | | | **5** | | | | | 0-10 VDC |
| | | | **6** | | | | | 1-5 VDC |
| | | | | | | | | Output (Pressure) |
| | | | | **0** | | | | 3-15 PSIG / 0.2-1.0 BAR |
| | | | | **1** | | | | 3-27 PSIG / 0.2-1.9 BAR |
| | | | | **2** | | | | 6-30 PSIG / 0.4-2.1 BAR |
| | | | | **3** | | | | 0-15 PSIG / 0-1.0 BAR |
| | | | | **4** | | | | 0-30 PSIG / 0-2.1 BAR |
| | | | | **5** | | | | 0-60 PSIG / 0-4.1 BAR |
| | | | | **6** | | | | 0-120 PSIG / 0-8.3 BAR |
| | | | | | | | | Electrical Connection |
| | | | | | **0** | | | 1/2 NPT (1/4 NPT Ports Only) |
| | | | | | **1** | | | Terminal Block (Indoor Use / General Purpose Only) |
| | | | | | **2** | | | Hirschmann® Connection (DIN 43 650-A) |
| | | | | | **3** | | | 1/2 BSPT Conduit (1/4 BSPT or BSPP Ports Only) |
| | | | | | | | | Elastomer |
| | | | | | | **0** | | Nitrile |
| | | | | | | **1** | | Fluorocarbon |
| | | | | | | | | Agency Approvals and Certifications |
| | | | | | | | **0** | FM, CSA and ATEX Intrinsically Safe |
| | | | | | | | **1** | None - General Purpose Only |

NOTE: Individual regulators, FRs, filters, and lubricators come complete with bracket.
FRL assemblies come complete with all bracket/connectors.

## T-1500 Manifold and Adapter Kit

### Principle of Operation

The T-1500 manifold assembly allows multiple T-1500 Transducers to be mounted in parallel. This minimizes the number of individual supply air lines required. Manifolds are available to hold three, five, or ten units. Each manifold comes with check valves so that a unit can be pulled off of the manifold for service or replacement without affecting the whole manifold. (See Figure 1.)

### Mounting

The manifolds may be mounted flush with a wall or cabinet or may be mounted away from the wall. Both mounting options are included in the basic manifold kit. In addition, all fittings required to mount the full number of units in each manifold are included in the basic kit. An additional adapter kit may be purchased which contains all of the hardware required to manifold mount a single T-1500 Transducer should the need arise.

### Air Supply Attachment

The air supply can be attached to either side of the manifold via a 3/4 NPT connection or to the back of the manifold via a 3/8 NPT connection. After an air supply port is selected, the open ports should be plugged using the plugs provided with the manifold kit and a pneumatic sealant.

### Output Air Attachment

Connect the output ports from each of the T-1500 Transducers to the bottom or back of the manifold. After connecting the transducers, plug the other 1/8 NPT ports using the plugs provided and a pneumatic sealant.

### T-1500 Manifold Adapter Kit

The T-1500 manifold kit includes the adapter kits required for each transducer.

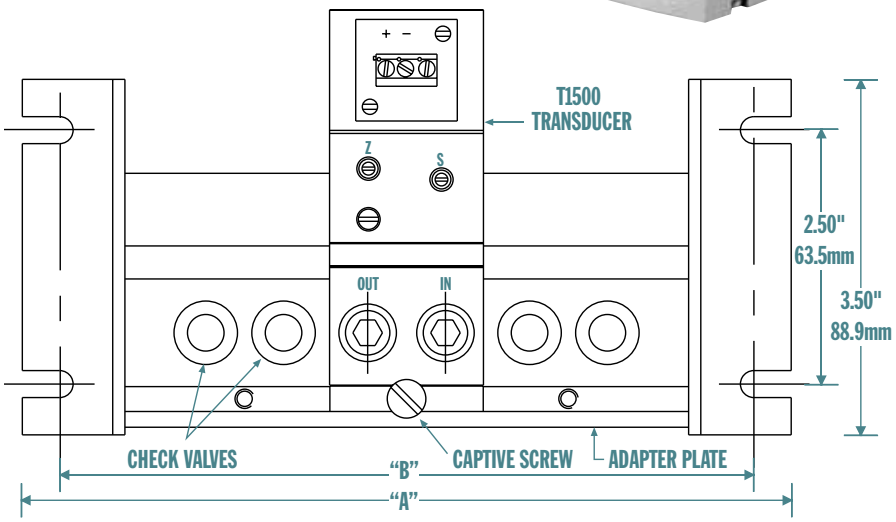
### Electrical Connections

Two brackets supplied with the manifold kit allow an electrical conduit to be attached to the manifold. Mounting screws and nuts are provided, and the brackets have an 11/64" diameter hole which will fit standard 8-36 UNF or 8-32 UNC screws (not supplied).

## Type 1500 Dimensions

| Number of Transducers | Length A | Length B |
|---|---|---|
| 3 | 7.57" 192.3 mm | 6.83" 173.5 mm |
| 5 | 10.75" 273.1 mm | 10.01" 254.3 mm |
| 10 | 18.70" 475.0 mm | 17.96" 456.2 mm |

### Figure 1 - Manifold Front View



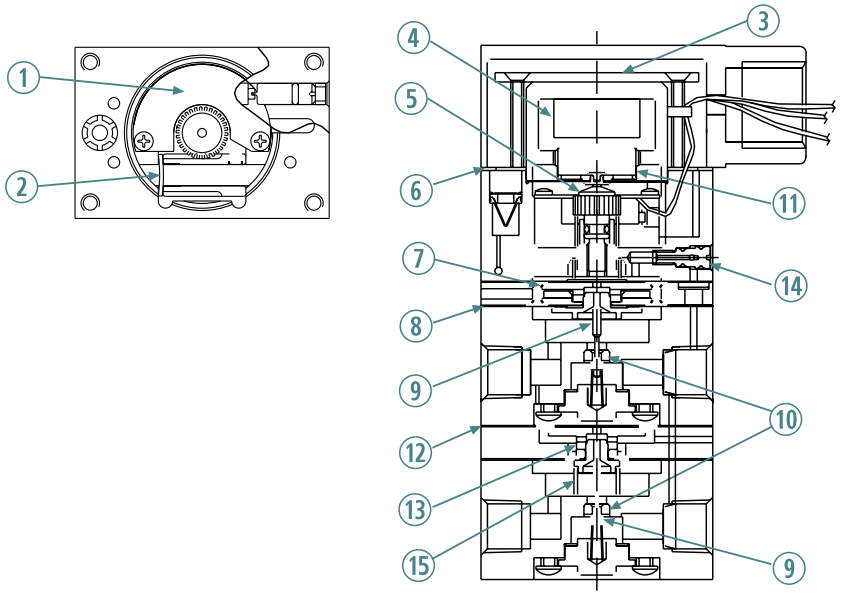

## Type 1500 Manifold Ordering Information

| Kit | Part Number |
|---|---|
| T-1500 Wall Mount Kit, 3 unit | 010-606-000 |
| T-1500 Wall Mount Kit, 5 unit | 010-606-001 |
| T-1500 Wall Mount Kit, 10 unit | 010-606-002 |
| T-1500 Manifold Adapter Kit (Replacement) | 010-602-000 |
| DIN Rail Mounting Kit | 971-140-000 |
| Pneumatic Repair Kit (3-15, 3-27 PSIG / 0.2-1.0, 0.2-1.9 BAR) | 971-141-000 |
| Pneumatic Repair Kit (6-30 PSIG / 0.4-2.1 BAR) | 971-141-002 |
| Pneumatic Repair Kit, Fluorocarbon (3-15, 3-27 PSIG / 0.2-1.0, 0.2-1.9 BAR) | 971-141-003 |
| Pneumatic Repair Kit, Fluorocarbon (6-30 psig / 0.4-2.1 BAR) | 971-141-004 |
| Pneumatic Repair Kit (0-120 PSIG / 0-8.3 BAR) | 971-145-000 |
| Pneumatic Repair Kit Fluorocarbon, (0-120 psi / 0-8.3 BAR) | 971-145-001 |
| Electronic Repair Kit (4-20 mA) | 971-142-000 |
| Electronic Repair Kit (0-5 VDC or 1-5 VDC) | 971-142-001 |
| Electronic Repair Kit (1-9, 1-10 VDC, or 0-10 VDC) | 971-142-002 |
| 2" Pipe Mounting Kit | 971-159-000 |
| Filter Kit, 60 Micron | 010-139-000 |

## Type 1500 Extended Range Parts

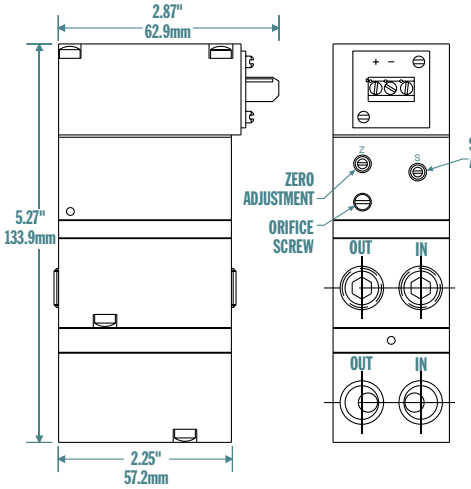
| Number | Description |
|---|---|
| 1 | Circuit Board |
| 2 | Worm Gear |
| 3 | Duckbill Valve (NEMA 4X Only) |
| 4 | Magnet Assembly |
| 5 | Nozzle Assembly |
| 6 | Bonnet Gasket (NEMA 4X Only) |
| 7 | Servo Diaphragm (I/P Section) |
| 8 | Control Diaphragm (I/P Section) |
| 9 | Pintle |
| 10 | Supply Seat |
| 11 | Coil/Flexure Assembly |
| 12 | Servo Diaphragm (Bias Relay) |
| 13 | Control Diaphragm (Bias Relay) |
| 14 | Orifice Screw |
| 15 | Bias Spring |

### Figure 2: Type 1500 Extended Range Parts

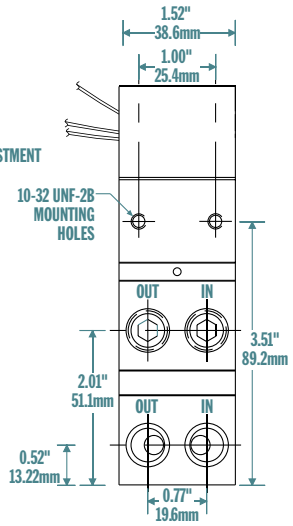



## Type 1500 Extended Range Dimensions

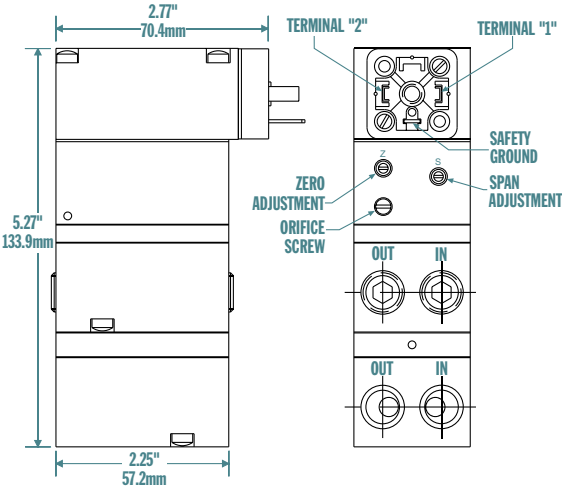
### Figure 3: Terminal Block



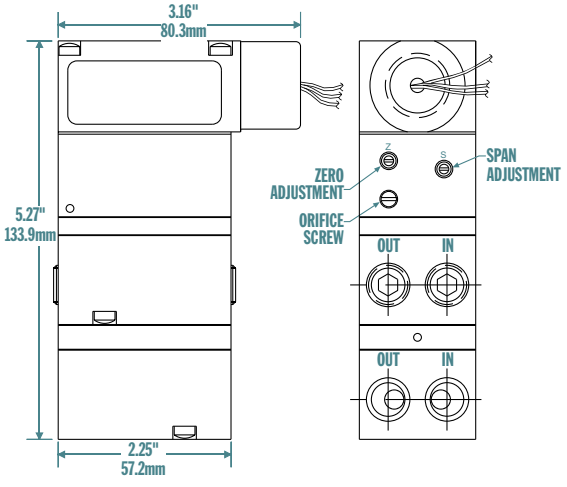

### Back Dimensions




### Figure 4 - Hirschmann® (DIN 43 650-A)




### FIGURE 5: 1/2 NPT / BSPT

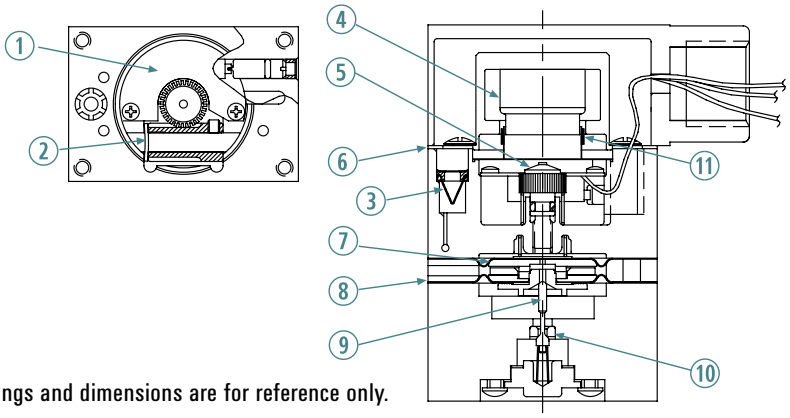


Drawings and dimensions are for reference only.

## Type 1500 Standard Range Parts

| Number | Description |
|---|---|
| 1 | Circuit Board |
| 2 | Worm Gear |
| 3 | Duckbill Valve (NEMA 4X Only) |
| 4 | Magnet Assembly |
| 5 | Nozzle Assembly |
| 6 | Bonnet Gasket (NEMA 4X Only) |
| 7 | Servo Diaphragm (I/P Section) |
| 8 | Control Diaphragm (I/P Section) |
| 9 | Pintle |
| 10 | Supply Seat |
| 11 | Coil/Flexure Assembly |

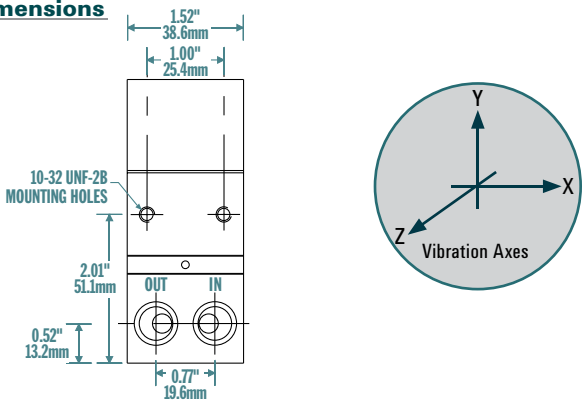
### Figure 6: Type 1500 Standard Range Parts



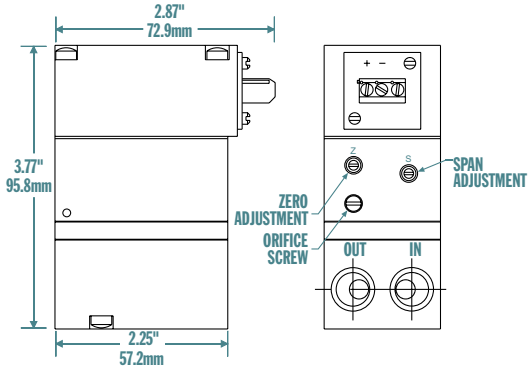

Drawings and dimensions are for reference only.

## Type 1500 Standard Range Dimensions

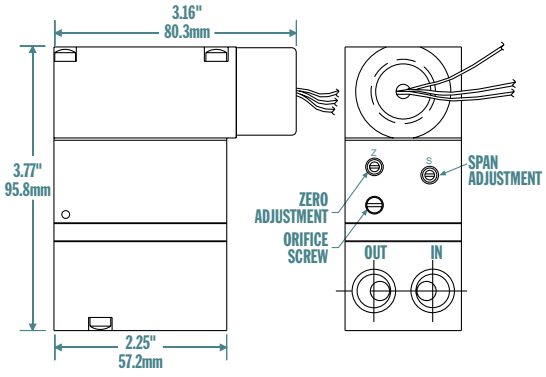
### Back Dimensions



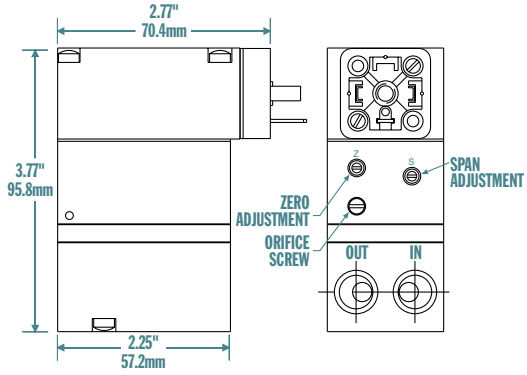

### Figure 7: Terminal Block




### FIGURE 8: 1/2 NPT / BSPT




### Figure 9: Hirschmann® (DIN 43 650-A)




## Agency Approvals - Applies only to units ordered with approvals

**Factory Mutual**
**T-1500 I/P and E/P Transducers**
**Intrinsically Safe:** Class I, Division 1, Groups A, B, C, & D, T4 Ta = 70°C; Entity;
**Non-Incendive:** Class I, Division 2, Groups A, B, C, & D, T4 Ta = 70°C
**Dust-Ignition Proof:** Classes II & III, Division 1, Groups E, F, & G, T4 Ta = 70°C
**Suitable:** Classes II & III, Division 2, Groups F & G, T4 Ta = 70°C Type 4X **NEMA 4X**
Entity Parameters: $V_{Max}$ = 30 V dc, $I_{Max}$ = 100 mA, $C_i$ = 0 µF, $L_i$ = 0 mH.

**Canadian Standards Association**
**T-1500 I/P Transducers Hazardous Locations:** Class I, Division 2, Groups A, B, C, & D; Type 4X **NEMA 4X**:
I/P transducer, rated $V_{Max}$ = 30V dc, $I_{Max}$ = 100mA. Temp Code T4. Max ambient 70°C.
IN COMPLIANCE WITH STD C22.2 No 213.
**Intrinsically Safe, Entity - Hazardous Locations:** Class I, Groups A, B, C, & D; Class II, Group E, F, & G; Class III; Type 4X **NEMA 4X**:
I/P transducer. Entity Parameters: $V_{Max}$ = 30V dc, $I_{Max}$ = 100mA, $C_i$ = 0, $L_i$ = 0. Intrinsically Safe when connected per Installation Instruction 010632. Temp Code T4. Max ambient 70°C.

**ATEX**
**Intrinsically safe** for II 1 G EEx ia IIB T4 Tamb = -20 to 65 ˚C
Input Parameters: $V_{Max}$ = 30V, Pi = 1W, Ii = 100 mA, Req = 180 OHMS, $C_i$ = 0, $L_i$ = 24mH

Models are CE marked for use in the European Union, and meet the EMC heavy machinery directives.

The Bellofram T-1500 Transducers were tested and found to comply with Electromagnetic Compatibility Directive effective January 1, 1996. The relevant EMC specifications tested were the following: EN 50081-1 (1992) and EN 50082-1 (1992). A Technical Construction File, Serial #107 was written and Certificate of Conformity issued by a Competent Body

# Type 2000

## I/P & E/P Transducers

### Description

The Marsh Bellofram Type 2000 is a robust electronic instrument that regulates an incoming supply pressure down to a precise output pressure which is directly proportional to an electrical control signal. The secret to the Type 2000's precise, reliable performance under a variety of demanding environmental conditions is a patented piezo-ceramic actuator with many industry-wide firsts.

The Type 2000 has been designed to meet the electro-pneumatic needs of the world:

- Field-selectable inputs and direct/reverse/split ranging
- Multiple input/output/mounting configurations
- Precise, reliable performance under extreme conditions of temperature, vibration, orientation, supply pressure changes, supply voltage changes, RFI/EMI, humid / oil-laden media, and corrosive surroundings

### Applications

The Type 2000's precisely regulated pneumatic output can be used to operate:

- Valve Actuators
- Louver and Damper Actuators
- Valve Positioners
- Relays
- Clutches and Brakes
- Controllers
- Air Cylinders

### Industry Applications Include

- Chemical and Petrochemical Industries
- Petroleum Production
- Pipeline Transmission
- Electric Utilities
- Water and Wastewater Systems
- Pulp and Paper
- Textiles
- Semiconductor Industry
- Food and Beverage
- Environmental Control Systems
- Construction Equipment
- Agricultural Equipment
- Machine Tool
- Material Handling
- Automotive Testing and Assembly
- Medical Equipment

### Principle of Operation

The Type 2000 I/P and E/P transducers utilize closed-loop pressure feedback-control for precision pressure output and minimized effects of temperature, supply pressure changes, supply voltage changes, and mounting angle.

Supply pressure is reduced by the supply valve to provide an output pressure which is internally routed to a precision temperature compensated piezo-resistive pressure sensor. Supply pressure is also routed to an externally removable orifice which provides a reduced pilot pressure to a chamber containing a servo diaphragm and nozzle. Pilot pressure is controlled by modulating the gap between the face of a nozzle and an adjacent piezo-ceramic actuator, which is part of a unique patented mechanism.

The piezo-ceramic actuator serves as a control link between electrical input and pressure output as follows:

- The input current (I/P) or voltage (E/P) signal is conditioned to provide a normalized control signal directly proportional to the desired pressure output.
- Simultaneously the output of the pressure sensor is amplified and conditioned to produce a feedback signal.
- The sum of the control signal and the feedback signal produce a command signal which is delivered as a DC voltage to the piezo-ceramic actuator.
- As voltage increases, the force applied by the actuator increases, so as to restrict nozzle bleed and thus increase pilot pressure.
- Increased pilot pressure applied to the servo diaphragm directly causes opening of the supply valve and an increase in the output pressure until the output feedback signal and control signal combine to produce the correct command signal.

### Fine-Tuning Your Application

For optimal performance in your application, the calibration of the Type 2000 can be fine-tuned in the field. An easily-removable cover provides access to the isolated electronics. All potentiometers, connections, jumpers, and switches are clearly marked on the circuit board or on the handy chart located on the inside of the cover. The three elements of calibration (Gain, Zero, and Span) are described below. Consult the Type 2000 User's Manual for detailed calibration procedures, cautions, and instrumentation requirements.

### Gain (Damping) Adjustment

The output response of the Type 2000 can be optimized for varying downstream volumes by adjusting the system gain of the control circuit. Adjust the Gain Pot counterclockwise for increased gain; clockwise for increased oscillation damping. For maximum allowable gain in your application, the pot should be turned clockwise until oscillation just disappears.

### Zero and Span Adjustments

The Type 2000 contains multi-turn Coarse-Zero, Fine-Zero, and Span adjustment potentiometers which are clockwise positive. Adjustment of either Zero Pot changes the unit's minimum output while the Span Pot changes the maximum output. The adjustments are interactive, so it may take iterations to reach the desired calibration.

### Wide Rangeability

The Type 2000 can be field calibrated to pressure ranges other than the standard ones by combinations of recalibration, pressure range switching, and split high/low ranging. A unit should not be switched to a range outside its pressure sensor family (eg., a 0-15 PSIG can be switched to a 3-15 PSIG, but not to 0-30 PSIG). (Caution: Do not exceed the range of the onboard pressure sensor.) For example, the easiest way to recalibrate a 0-30 PSIG unit to 3-15 psig would be to change the switch setting to 3-27 PSIG, then switch to split range low.

### Field-Selectable Features

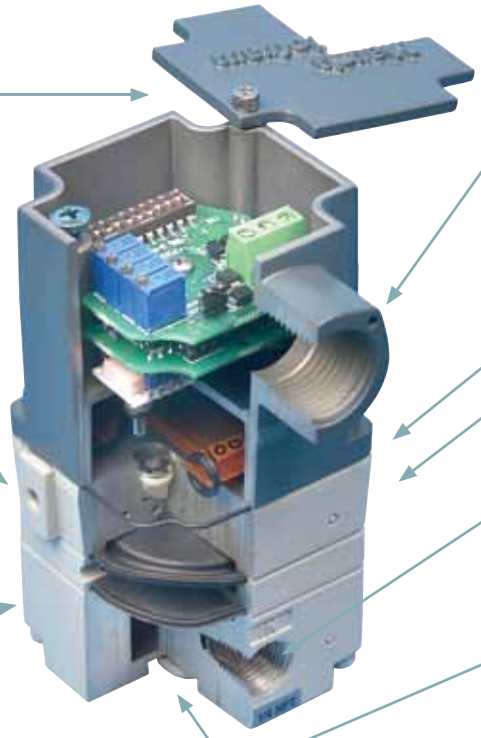
Onboard switches allow the user to easily reconfigure the Type 2000 for any of several electrical inputs, direct/reverse acting, or output split-ranging high/low. Fine tuning of the unit's calibration may be necessary after a reconfiguration.

## Direct/Reverse Acting

Direct Acting transducers regulate to their minimum output when supplied with minimum input; maximum out with maximum in. Reverse Acting transducers regulate to their maximum output at minimum input.

## Split Ranging (High or Low)

The Type 2000 can be configured to regulate either half (top or bottom) of its normal output range, when supplied with its normal full-ranging electrical input. For example, a 0-10V 0-30 PSI unit set to split range low will regulate 0-15 PSI @ 0-10V. It will regulate 15-30 PSI @ 0-10V if set to split range high.



**Easy Access Top Cover**
1) Isolated electronics
2) Calibration adjustments
3) Configuration switches
4) Switch information on inside of cover

**Mounting Options**
1) In-Line
2) Direct: Holes on left rear and bottom faces
3) Bracket Mounting options: Panel, Pipe, Valve, DIN-Rail

**Integral Booster**
Flows up to 21 scfm for quick system response

**Gauge Port**
1/8 NPT on all models
(Not shown; rear face)

**Electrical Port Options**
1) 1/2 NPT Conduit
2) 20mm Conduit
3) Hirschmann® (DIN 43 650-A)
4) Terminal Block

**Easy Access Orifice**

**Output Port**
Same as Input Port
(Not shown; rear face)

**Input Port Options**
1) 1/4 NPT
2) 1/4 BSPP
3) 1/4 BSPT

**Manifold-Mounting Option**
Supply and Output ports on the bottom face rather than "through the body"

## Agency Approvals - Applies only to units ordered with approvals

**Factory Mutual**
**T-2000 I/P & E/P Transducers** Explosion Proof / Intrinsically Safe Model
**Explosion Proof:** Class I, Division 1, Groups A, B, C, & D, T6 Ta = 60°C
**Dust-Ignition Proof:** Classes II & III, Division 1, Groups E, F, & G , T6 Ta = 60°C; Type 4X **NEMA 4X**, IP66
**Intrinsically Safe:** Classes I, II, & III, Division 1, Groups A, B, C, D, E, F, & G , T4 Ta = 60°C; Entity; Type 4X **NEMA 4X**, IP66
**Non-Incendive:** Class I, Division 2, Groups A, B, C, & D, T4 Ta = 60°C
**Suitable:** Class II, Division 2, Groups F & G , T4 Ta = 60°C
**Suitable:** Class III, Division 2, T4 Ta = 60°C, Type 4X, IP66
Entity Parameters:
Input Option b = 42: $V_{Max}$ = 30 V, $I_{Max}$ = 200 mA, $P_{Max}$ = 1 W, $C_i$ = 0, $L_i$ = 0.
Input Option b = 01, 05, 11, 15 or 19: $V_{Max}$ = 30 V, $I_{Max}$ = 100 mA, $P_{Max}$ = 0.75 W, $C_i$ = 0, $L_i$ = 0.
Special Conditions of Use:
The T-2000 Non-Incendive not for use with natural gas or other non-inert gases as a process medium.

**T-2000 E/P or I/P Transducers** Intrinsically Safe Model
**Intrinsically Safe:** Classes I, II, & III, Division 1, Groups A, B, C, D, E, F, & G, T4 Ta = 60°C; Entity;
**Non-Incendive:** Class I, Division 2, Groups A, B, C, & D, T4 Ta = 60°C
**Suitable:** Class II, Division 2, Groups F & G, T4 Ta = 60°C
**Suitable:** Class III, Division 2, T4 Ta = 60°C Type 4X **NEMA 4X**
Entity Parameters:
When Electrical Input Option *c* = 42: VMax = 30 V, IMax = 200 mA, PMax = 1 W, $C_i$ = 0, $L_i$ = 0.
When Electrical Input Option *c* = 05, 15, 19, 11 or 01: $V_{Max}$ = 30 V, $I_{Max}$ = 100 mA, $P_{Max}$ = 0.75 W, $C_i$ = 0, $L_i$ = 0.

**T-2000 E/P or I/P Transducers** Intrinsically Safe with Terminal Block Model
**Intrinsically Safe:** Class I, Division 1, Groups A, B, C, & D, T4 Ta = 60°C Entity;
**Non-Incendive:** Class I, Division 2, Groups A, B, C, & D, T4 Ta = 60°C
Entity Parameters:
When Electrical Input Option c = 42: $V_{Max}$ = 30 V, $I_{Max}$ = 200 mA, $P_{Max}$ = 1 W, $C_i$ = 0, $L_i$ = 0.
When Electrical Input Option c = 05, 15, 19, 11 or 01: $V_{Max}$ = 30 V, $I_{Max}$ = 100 mA, $P_{Max}$ = 0.75 W, $C_i$ = 0, $L_i$ = 0.

**Canadian Standards Association - T-2000 I/P & E/P Transducers**
**Hazardous Locations:** Class I, Division 1, Groups A, B, C, & D; Class II, Groups E, F & G; Class III.

**Explosion proof I/P & E/P Transducer**, Rated: 28Vdc, 8mA; T-Code T6; Enclosure Type 4X **NEMA 4X**, IP66;
Max Ambient Temperature: +60°C. IN COMPLIANCE WITH STD C22.2 No 213.

**T-2000 I/P & E/P Transducers**
**Intrinsically Safe, Entity - Hazardous Locations:** Class I, Divisions 1 & 2, Groups A , B, C, & D; Class II, Division 1, Groups E, F, & G, Division 2, Groups F & G; Class III Hazardous Locations
Electro-Pneumatic I/P and E/P Transducers. Maximum Ambient Temperature: +60°C. Enclosure Type 4X **NEMA 4X**, T4. Intrinsically Safe when installed.
**Explosion proof:** Class I, Division 1, Groups A, B, C & D; Class II, Groups E, F, & G; Class III. **NEMA 4X**
Rated: 28Vdc, 8mA; T-Code T6; Enclosure Type 4X, IP66; Max Ambient Temperature: +60°C. Intrinsically Safe when installed. Two sets of Entity Parameters may be used in the installation of this product.
Entity Parameters
I/P: $V_{Max}$ = 30V $I_{max}$ = 200mA $P_{Max}$ = 1.0W $C_i$ = 0mF $L_i$ = 0mH
E/P: $V_{Max}$ = 30V $I_{Max}$ = 100mA $P_{Max}$ = 0.75W $C_i$ = 0mF $L_i$ = 0mH

**ATEX** (EUROPEAN MODEL)
**T-2000 I/P & E/P Transducers**
**INTRINSIC SAFETY:** II 1 G EEx ia IIC T4 (-20<Ta<+60) EN 50014:1997 (A2) EN 50020:1994 EN 500284:1999

**ENTELA**
**T-2000 I/P Transducers**
**Explosion Proof:** Class I, Division I, Groups C and D, T3.
Exia IIB Ci=0 Li=0, 24VDC, 25mA
Note: Meets the requirements for CSA Class I Div. 1, Group D media gas (Natural Gas Use) Also includes factory conduit seal. EN 50081-1 Residential, commercial & light industry, EN-50082-2 Heavy Industrial. Certified to CSA C22.2 No 30,14,157,1010

The Bellofram T-2000 Transducers were tested and found to comply with Electromagnetic Compatibility Directive effective January 1, 1996. The relevant EMC specifications tested were the following: EN 50081-1 (1992) and EN 50082-1 (1992). A Technical Construction File, Serial #107 was written and Certificate of Conformity issued by a Competent Body.

## Type 2000 Specifications

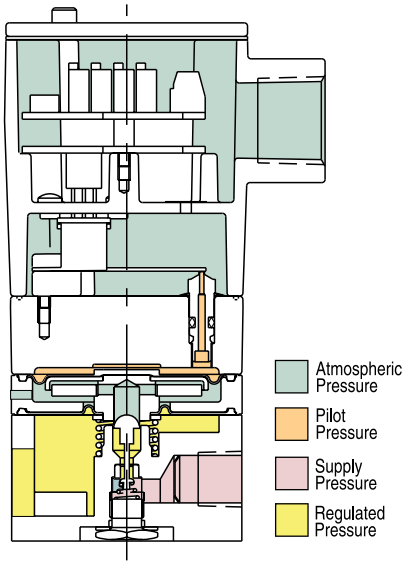
| | |
|---|---|
| Accuracy | 0.1% of full-scale output typical (0.25% guaranteed); includes effects of hysteresis, dead band, and repeatability |
| **Electrical** | |
| Inputs | Switch-Selectable<br>4-20mA. 0-5, 1-5, 1-9, 1-10, or 0-10VDC |
| Connections | 1/2 NPT or 20mm Conduit<br>DIN Hirschmann (S model only)<br>External Terminal Block (S model only) |
| Power Supply | 5-28VDC (with voltage inputs only) |
| Direct/Reverse Acting | Switch-Selectable |
| **Pneumatic** | |
| Outputs | 0-5, 0-15, 3-15, 1-17, 0-30, 6-30, 3-27, 0-60, 0-100, or 120 PSIG<br>0-0.1, 0-0.3, 0-1.0, 0.2-1.0, 0.07-1.2, 0-2.1, 0.4-2.1, 0.2-1.9,<br>0-4.1, 0-6.9, 0-8.3 BAR |
| Ports (Input/Output) | 1/4" (NPT, BSPT, or BSPP threads)<br>Bottom-ported for Manifold Mounting |
| Exhaust | (Explosion proof only) 1/8 - 27 NPT |
| Ports (Gauge) | 1/8 NPT |
| Supply | For 0–5 PSIG (0.3 BAR) Through 0–60 PSIG<br>From 5 PSIG (0.3 BAR) above maximum output to 100 PSIG maximum<br>For 0-100 PSIG and 0–120 PSIG Ranges<br>From 5 PSIG (0.3 BAR) above maximum output to 140 PSIG maximum |
| Split-Ranging | Switch-Selectable, Full-Range or Split-Range High or Split-Range Low |
| Consumption | 4 SCFH maximum (1.9 LPM) |

**Flow Capacity**

| Range | | Sensor | | Flow | |
|---|---|---|---|---|---|
| PSIG | BAR | PSIG | BAR | SCFM | LPM |
| 0-5 | 0-0.3 | 5 | 0.3 | 11 | 312 |
| 0-15 | 0-1.0 | 15 | 1.0 | 15 | 423 |
| 3-15 | 0.2-1.0 | 15 | 1.0 | 15 | 423 |
| 1-17 | 0.07-1.2 | 15 | 1.0 | 15 | 423 |
| 0-30 | 0-2.1 | 30 | 2.1 | 15 | 423 |
| 3-27 | 0.2-1.9 | 30 | 2.1 | 15 | 423 |
| 6-30 | 0.4-2.1 | 30 | 2.1 | 15 | 423 |
| 0-60 | 0-4.1 | 50 | 3.5 | 17 | 480 |
| (Typical Flow @ 100 PSIG (6.9 BAR) in and maximum out) | | | | | |
| 0-100 | 0-6.9 | 100 | 6.9 | 21 | 595 |
| 0-120 | 0-8.3 | 100 | 6.9 | 21 | 595 |
| (Typical Flow @ 140 PSIG (9.7 BAR) in and maximum out) | | | | | |

| | |
|---|---|
| Exhaust Capacity | 3 SCFM (85 LPM) @ 5 PSIG (0.3 BAR) above setpoint<br>(0-15 PSIG range unit set at mid range) |
| Stability | |
| Supply Voltage Effect | None |
| Supply Pressure Effect | None |
| Vibration Effect | <1% FS (+/-1G; 5-1000Hz) |
| Mounting Position Effect | None |
| RFI/EMI | CE-Compliant |
| Temperature Effect | 0.02% FS/˚F (-40˚ to 180˚F [-40˚ to 82˚C]) |
| Storage Temperature | -40˚to 200˚F (-40 to 93˚C) |
| Approximate Weight | 3.0 lbs, 1.35 kg |

**The secret to the Type 2000's precise, reliable performance under a variety of demanding environmental conditions is a patented piezo-ceramic actuator with many industry-wide firsts.**

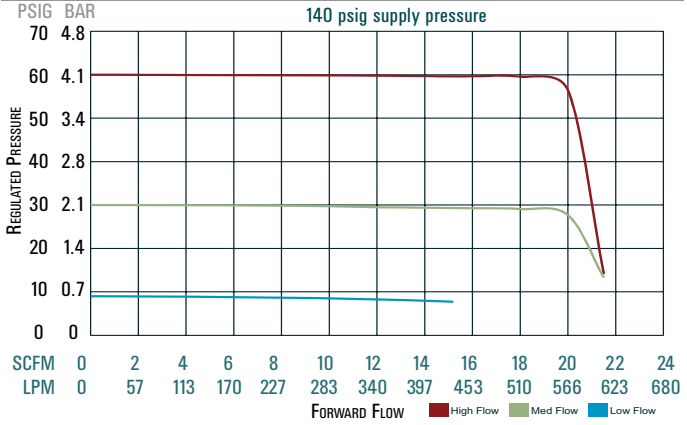



### Air Quality

Instrument-quality air consists of:

a. A dew point less than 35º F
b. No particles larger than three microns
c. Maximum oil content of 1 ppm

### TYPE 2000: REGULATED PRESSURE VS. FLOW




### Type 2000 Mounting Options

| Mounting Method | Intrinsically-Safe (S) Model | Explosion-Proof (E) Model |
|---|---|---|
| In-Line | Yes | Yes |
| Direct Mounting | Side or Bottom Holes | Side or Bottom Holes |
| Panel Bracket | Supplied | Accessory |
| Valve Bracket | Accessory | Supplied |
| Pipe Bracket | Accessory | Accessory |
| DIN-Rail Bracket | Accessory | Accessory |
| Manifold Plate | Accessory | Accessory |

Mounting: The Type 2000 can be mounted in-line, or directly to a panel via mounting holes located in the side and bottom of the unit. In addition, the S model includes a panel-mounting bracket; while the E model includes a valve-mounting bracket. Kits are available for mounting of either model to panel, valve, pipe, or DIN-Rail. A custom plate is available for mounting of the bottom-ported version to a manifold. (See Accessories)

## Type 2000 Ordering Information

| 2 K | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Enclosure |
| | S | | | | | | | | | Intrinsically Safe |
| | E | | | | | | | | | Explosion Proof |
| | | | | | | | | | | Electrical Port[1] |
| | | N | | | | | | | | 1/2 NPT Conduit |
| | | M | | | | | | | | 20mm Conduit "S" Unit Only |
| | | H | | | | | | | | Hirschmann[5] |
| | | T | | | | | | | | Terminal Block[2] "S" Unit Only |
| | | | | | | | | | | Pneumatic Ports |
| | | | N | | | | | | | NPT |
| | | | T | | | | | | | BSPT |
| | | | P | | | | | | | BSPP |
| | | | M | | | | | | | Manifold Mount[3] |
| | | | | | | | | | | Agency Approval[6] |
| | | | | F | | | | | | FM/CSA |
| | | | | C | | | | | | ATEX "S" Unit Only |
| | | | | G | | | | | | Certified to CSA Standards[4] |
| | | | | | | | | | | Electrical Input |
| | | | | | 42 | | | | | 4-20 mA |
| | | | | | 05 | | | | | 0-5 V |
| | | | | | 15 | | | | | 1-5 V |
| | | | | | 19 | | | | | 1-9 V |
| | | | | | 11 | | | | | 1-10 V |
| | | | | | 01 | | | | | 0-10 V |
| | | | | | | | | | | Mode |
| | | | | | | D | | | | Direct Acting |
| | | | | | | R | | | | Reverse Acting |
| | | | | | | | | | | Mode |
| | | | | | | | F | | | Full Range |
| | | | | | | | H | | | Split Range High |
| | | | | | | | L | | | Split Range Low |
| | | | | | | | | | | Pneumatic Output |
| | | | | | | | | 005 | | 0-5 PSIG 0-0.3 BAR |
| | | | | | | | | 015 | | 0-15 PSIG 0-1.0 BAR |
| | | | | | | | | 315 | | 3-15 PSIG 0.2-1.0 BAR |
| | | | | | | | | 117 | | 1-17 PSIG 0.07-1.2 BAR |
| | | | | | | | | 030 | | 0-30 PSIG 0-2.1 BAR |
| | | | | | | | | 630 | | 6-30 PSIG 0.4-2.1 BAR |
| | | | | | | | | 327 | | 3-27 PSIG 0.2-1.9 BAR |
| | | | | | | | | 060 | | 0-60 PSIG 0-4.1 BAR |
| | | | | | | | | | | |
| | | | | | | | | 100 | | 0-100 PSIG 0-6.9 BAR |
| | | | | | | | | 120 | | 0-120 PSIG 0-8.3 BAR |
| | | | | | | | | | | Special |
| | | | | | | | | | 00 | None |

Maximum Supply for these regulators is 100 PSIG

Maximum Supply for these regulators is 140 PSIG

## Type 2000 Accessories

| | Part Number |
|---|---|
| Panel Mounting Kit | 010-135-000 |
| Valve Mounting Kit | 010-134-000 |
| 2" Pipe Mounting Kit (Valve Mounting Kit is required) | 010-143-000 |
| DIN Rail Adapter | 010-115-000 |
| Manifold Adapter Kit | 971-158-000 |
| Filter Kit, 60 microns | 010-139-000 |
| Pressure Gauge Kit 15 PSIG (1 BAR) | 010-138-000 |
| Pressure Gauge Kit 30 PSIG (2.1 BAR) | 010-138-001 |
| Pressure Gauge Kit 60 PSIG (4.1 BAR) | 010-138-002 |
| Pressure Gauge Kit 160 PSIG (11 BAR) | 010-138-003 |

## Type 2000 Notes

| [1] Availability | | | Enclosure S | Enclosure E |
|---|---|---|---|---|
| Electrical Port | | N | Yes | Yes |
| | | M | Yes | Yes |
| | | H | Yes | No |
| | | T | Yes | No |

[2] NEMA 4X / IP66 not available

[3] Bottom O-Ring Ports

[4] "E" Enclosure and "N" Electrical port required

[5] Not Agency Approved

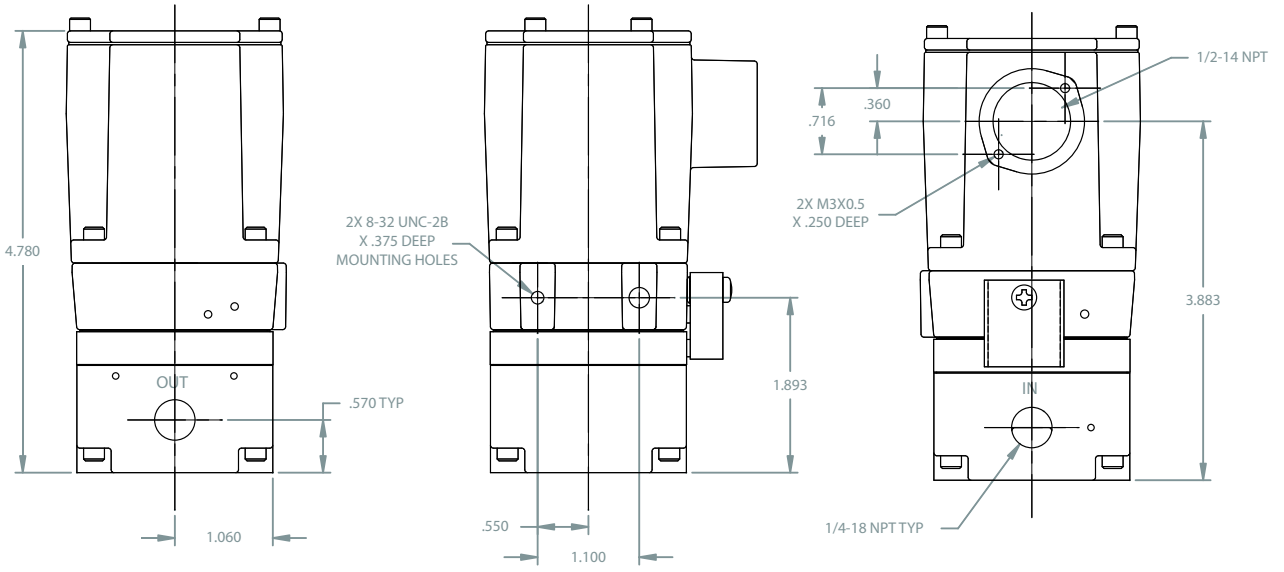
| [6] Agency Approval | | | F FM/CSA | C ATEX | G Gas |
|---|---|---|---|---|---|
| Enclosure | S | Intrinsic Safety | Yes | Yes | No |
| | E | Explosion Proof | Yes | No | Yes |

| Terminal Block | I/P Transducer | E/P Transducer |
|---|---|---|
| S | N/C | + Signal |
| + | + Signal | + Power Supply |
| - | - Signal | Common |

## Type 2000 Wiring Connections and Switch Positions

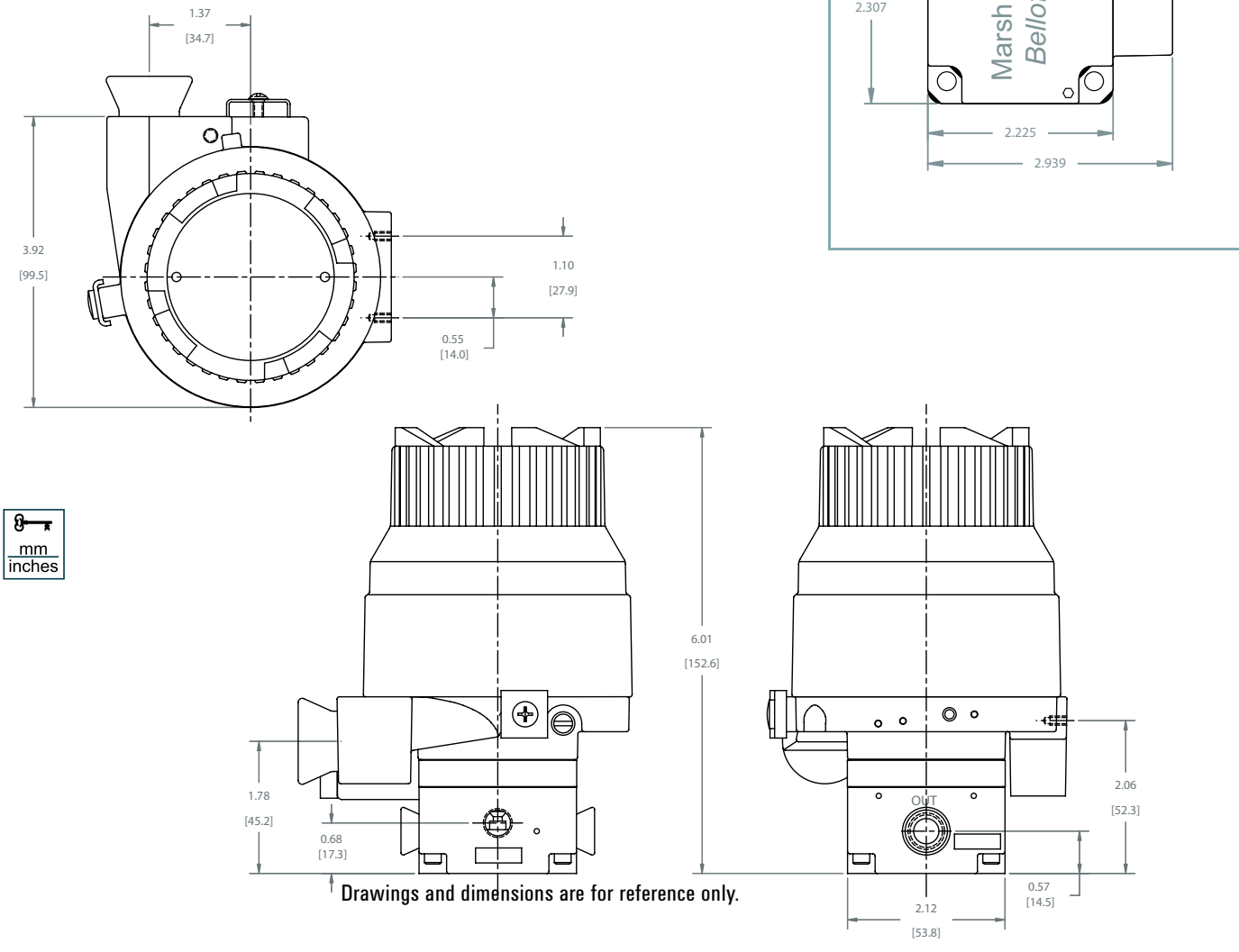
| Switch # | 1: PSIG | BAR | 2 | 3 | 4 | 5 | 6: psig | BAR | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ON | 0-15<br>3-15<br>1-17<br>0-30<br>3-27<br>6-30<br>0-100 | 0-1.0<br>0.2-1.0<br>0.07-1.2<br>0-2.1<br>0.2-1.9<br>0.4-2.1<br>0-6.9 | 1-5 VDC<br>0-5 VDC | Split Low | Voltage Input (E/P) | Split Low<br>Full | 0-15<br>1-17<br>0-30<br>0-60<br>0-100<br>0-120 | 0-1.0<br>0.07-1.2<br>0-2.1<br>0-4.1<br>0-6.9<br>0-8.3 | Reverse Acting | Full | I/P |
| Switch # | 1: PSIG | BAR | 2 | 3 | 4 | 5 | 6: psig | BAR | 7 | 8 | 9 |
| OFF | 0-60<br>0-120 | 0-4.1<br>0-8.3 | 1-9 VDC<br>0-10 VDC<br>4-20 mA | Full<br>Split High | Current Input (I/P) | Split High | 3-15<br>3-27<br>6-30 | 0.2-1.0<br>0.2-1.9<br>0.4-2.1 | Direct Acting | Split Low<br>Split High | E/P |

## Type 2000 Dimensions




mm
inches

## Type 2000 Explosion Proof Dimensions




mm
inches

Drawings and dimensions are for reference only.

# Type 5000
## P/I Transducers

### Description

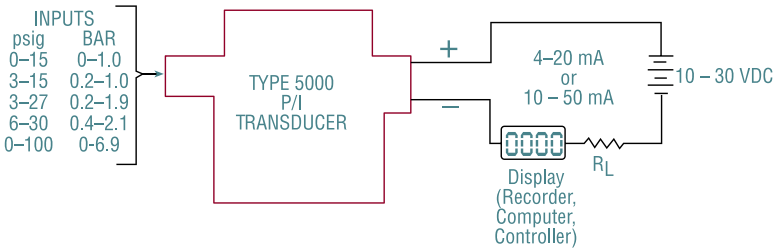
The Type 5000 series is a compact, rugged and reliable family of two-wire pressure transmitters designed for industrial field service. These instruments convert a signal pressure input into a precise 4-20 or 10-50mA output. The lightweight transmitter housing includes a 1/4 NPT pressure port and a 1/2 NPT conduit port for field wiring. Connections are easily accessible simply by removing the top cover. Zero and span adjustments are available within the field wiring compartment for fine, on-site calibration adjustment.

The Type 5000 uses a unique, temperature compensated piezo resistive sensor suitable for gauge pressure measurement of non-corrosive liquids and gases. The sensor has excellent dynamic response and is virtually insensitive to mounting orientation and ordinary industrial vibration. Mounting holes on the transmitter housing are arranged to permit direct pipe (2") mounting for minimum installed cost.

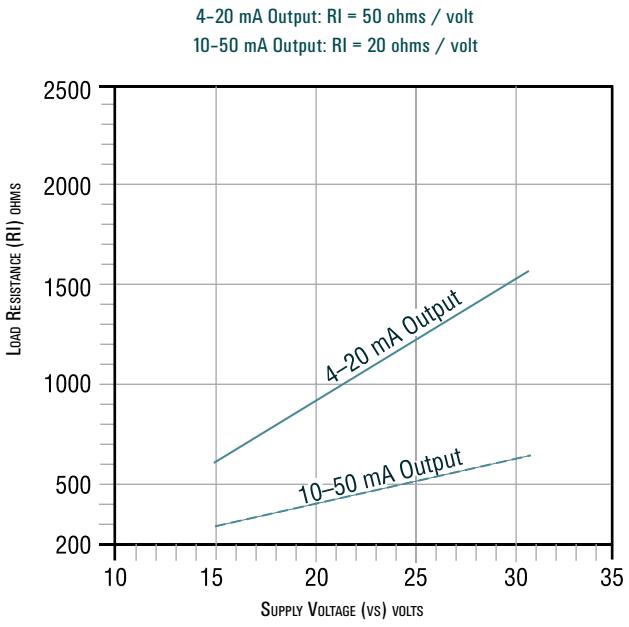
### Features

- 0.1% accuracy typical
- Piezo resistive pressure sensor resists vibration
- Mounts at any angle
- Easily accessible zero and span adjustments
- NEMA 4X housing approved for explosion proof service

### Type 5000 Functional Diagram




### TYPE 5000: Max Load Resistance VS. Supply Voltage



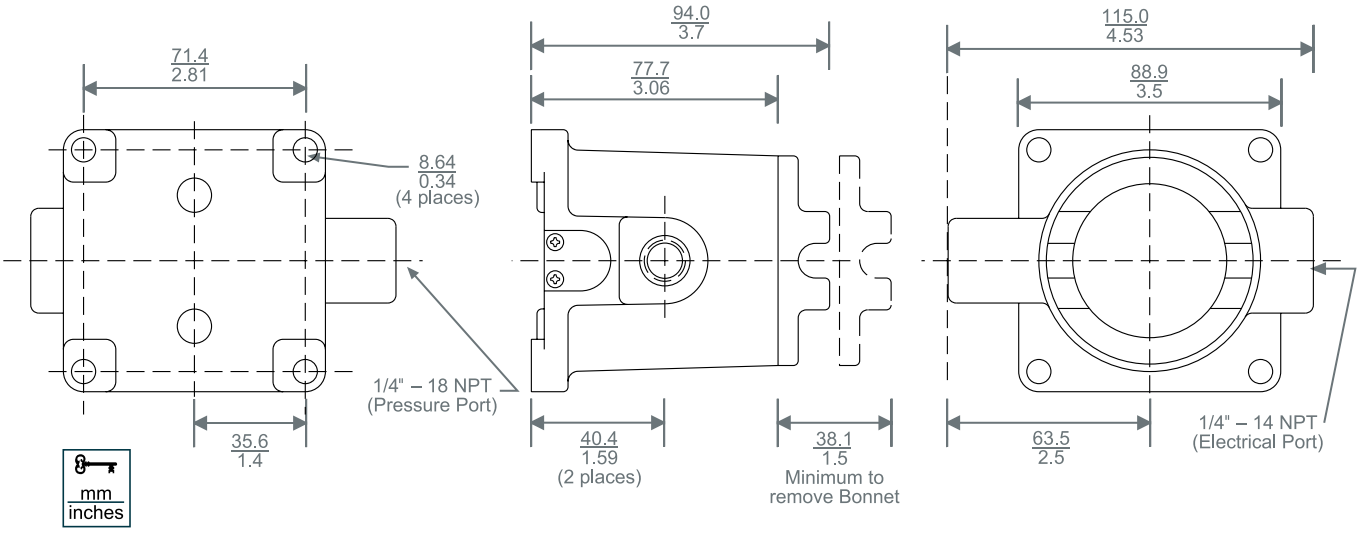

### Agency Approval Notes

**Factory Mutual**
**T-5000 P/I Transducers NEMA 4X**
**Explosion Proof:** Class I, Division 1, Groups B, C, & D, T6
**Dust-Ignition Proof:** Classes II & III, Division 1, Groups E, F, & G, T6, Type 4X **NEMA 4X**

**Canadian Standards Association**
**T-5000 P/I Transducers**
**Hazardous Locations**:
Class I, Groups B, C & D; Class II, Group E, F & G; Class III; Encl **4 NEMA** 4: P/I transmitter, rated output 4-20mA dc or 10-50mA dc, power supply 30V dc max.

The Bellofram T-5000 Transducers were tested and found to comply with Electromagnetic Compatibility Directive effective January 1, 1996. The relevant EMC specifications tested were the following: EN 50081-1 (1992) and EN 50082-1 (1992). A Technical Construction File, Serial #107 was written and Certificate of Conformity issued by a Competent Body

## Type 5000 Dimensions




## Type 1500 Specifications

| | | |
|---|---|---|
| Input signal | 0–15 PSIG | 0–1.0 BAR |
| | 3–15 PSIG | 0.2–1.0 BAR |
| | 3–27 PSIG | 0.2–1.9 BAR |
| | 6–30 PSIG | 0.4–2.1 BAR |
| | 0.2–1.0 BAR | 3–15 PSIG |
| | 0–100 PSIG | 0–6.9 BAR |
| Output Signal | 4–20 mA DC, 2 wire | |
| | 10–50 mA DC, 2 wire | |
| Output Protections | Reverse polarity protected | |
| Accuracy includes nonlinearity, hysteresis and non-repeatability | ± 0.1% span typical; ± 0.25% span max. | |
| Overpressure | 45 PSIG (3.1 BAR) without calibration shift<br>60 PSIG (4.1 BAR) without failure | |
| Allowable Loads | See Graph | |
| Response Time | Less than 10 msec for step change to 99% R | |
| Temperature Range-Operating | -40˚F to +180˚F (-40˚C to +82˚C) | |
| Temperature Effect | Zero - Less than ± 0.01% R/˚F<br>Span - Less than ± 0.01% R/˚F | |
| RFI Effect | Less than 1% R at 10V/meter per SAMA PMC 33.1, 2-abc | |
| Power Supply | 12–30 VDC | |
| Power Supply Effect | Less than 0.005% per volt change at the input terminals within specified power supply limits | |
| Calibration Adjustments | Multi-turn Zero and Span potentiometers with ± 25% min. adjustment | |
| In-Process Output Monitoring | Via test jacks within enclosure without disturbing field wiring | |
| Connections | 1/4 – 18 NPT female pressure input,<br>1/2 – 14 NPT female electrical output | |
| Mounting | Suitable bracket or optional 1/4–20 U-bolt pipe mounting kit (P/N 971-109-000) | |
| Finish | Epoxy coated aluminum body and cover | |
| Weight | 1.7 lbs. (0.8 kg) | |

## Type 5000 Ordering Information

| 9 | 6 | 4 | | | 1 | | |
|---|---|---|---|---|---|---|---|
| | | | ↑ | ↑ | ↑ | ↑↑↑ | Input |
| | | | 0 | | | | 0–15 PSIG (0–1.0 BAR) |
| | | | 1 | | | | 3–15 PSIG (0.2– 1.0 BAR) |
| | | | 2 | | | | 3–27 PSIG (0.2–1.9 BAR) |
| | | | 3 | | | | 6–30 PSIG (0.4–2.1 BAR) |
| | | | 4 | | | | 0.2–1.0 BAR (3–15 PSIG) |
| | | | 5 | | | | 0–100 PSIG (0–6.9 BAR) |
| | | | | | | | Output |
| | | | | 0 | | | 4–20 mA |
| | | | | 1 | | | 10–50 mA |
| | | | | | | | Agency approval |
| | | | | | 1 | | X /P FM/CSA |
| | | | | | | | Options |
| | | | | | | 000 | None |
| | | | | | | 001 | Pipe Clamp Mounting Kit |